FINAL PLAN AND FINAL ENVIRONMENTAL IMPACT STATEMENT

GREAT CREEK WATERSHED

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

ADDENDUM

GREAT CREEK WATERSHED PLAN

Brunswick and Lunenburg Counties, Virginia

Costs and benefits have been up-dated to 1976 values. The attached Tables 1, 2, 2A, 4, 5, and 6 provide these changes. At 1976 values annual project costs are $97,120. Benefits, excluding local secondary benefits, are estimated at $126,070, giving a benefit-cost ratio of 1.3 to 1.0. Inclusion of local secondary benefits increases the annual benefits to $143,470 and the benefit-cost ratio to 1.5 to 1.0.

June 1976

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Great Creek Watershed, Virginia

Installation Cost Item	Unit	Number: Non-Fed. Land	Number: Total	Estimated Cost (Dollars) 1/: P. L. 566 Funds: Non-Federal Land: SCS 2/	P. L. 566 Funds: Non-Federal Land: FS 2/	P. L. 566 Funds: Total	Other: Non-Federal Land: SCS 2/	Other: Non-Federal Land: FS 2/	Other: Total	TOTAL
LAND TREATMENT										
Land Areas 3/	Acres									
Cropland	to be	800	800				10,270		10,270	10,270
Pastureland	Treated	625	625				35,610		35,610	35,610
Forest Land		6,980	6,980					59,300	59,300	59,300
Other		33	33				9,080		9,080	9,080
Technical Assistance				70,900	30,200	101,100	10,030	16,700*	26,730	127,830
TOTAL LAND TREATMENT	xxx	xxx	xxx	70,900	30,200	101,100	64,990	76,000	140,990	242,090
STRUCTURAL MEASURES										
Construction										
Multiple-Purpose										
Structure 6A	No.	1	1	1,121,570		1,121,570	97,530		97,530	1,219,100
Raw Water Intake							8,400		8,400	8,400
Subtotal - Construction				1,121,570		1,121,570	105,930		105,930	1,227,500
Engineering Services				51,030		51,030	5,700		5,700	56,730
Project Administration										
Construction Inspection				57,900		57,900	5,000		5,000	62,900
Other				68,000		68,000	5,900		5,900	73,900
Subtotal - Administration				125,900		125,900	10,900		10,900	136,800
Other Costs										
Landrights							125,000		125,000	125,000
Subtotal - Other							125,000		125,000	125,000
TOTAL STRUCTURAL MEASURES				1,298,500		1,298,500	247,530		247,530	1,546,030
TOTAL PROJECT				1,369,400	30,200	1,399,600	312,520	76,000	388,520	1,788,120

* Includes $9,300 from Cooperative Forest Management Program and $2,500 from Cooperative Forest Fire Control Program.

1/ Price base 1976.

2/ Federal agency responsible for assisting in installation of works of improvement.

3/ Includes only areas estimated to be adequately treated or protected during the project installation period. Treatment will be accelerated throughout the watershed and dollar amounts apply to total land areas, not just adequately treated areas.

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Great Creek Watershed, Virginia

(Dollars) 1/

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds				Total Inst. Cost
	Construction	Engineering 2/	Total P. L. 566	Construction	Engineering 2/	Land 3/ Rights	Total Other	
Multiple-Purpose Structure	1,121,570	51,030	1,172,600	97,530	4,440	125,000	226,970	1,399,570
Raw Water Intake				8,400	1,260		9,660	9,660
Subtotal	1,121,570	51,030	1,172,600	105,930	5,700	125,000	236,630	1,409,230
Project Administration	xxx	xxx	125,900	xxx	xxx	xxx	10,900	136,800
GRAND TOTAL	1,121,570	51,030	1,298,500	105,930	5,700	125,000	247,530	1,546,030

1/ Price base 1976.
2/ Engineering contract costs to be borne $27,925 by P.L. 566 funds and $2,430 by Other Funds.
3/ Includes $2,180 for survey, legal fees and other costs.

Date: June 1976

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Great Creek Watershed, Virginia

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING					
	Purpose			P. L. 566			Other		
	Flood Prev.	Municipal Water Supply	Total	Flood Prev.	Municipal Water Supply	Total	Flood Prev.	Municipal Water Supply	Total
Multiple-Purpose Structure No. 6A	1,287,600	111,970	1,399,570	1,172,600		1,172,600	115,000	111,970	226,970
Raw Water Intake		9,660	9,660					9,660	9,660
GRAND TOTAL	1,287,600	121,630	1,409,230	1,172,600		1,172,600	115,000	121,630	236,630

1/ Price Base 1976.

Date: June 1976

TABLE 4 - ANNUAL COST

Great Creek Watershed, Virginia

(Dollars) 1/

Evaluation Unit	Amortization of 2/ Installation Cost	Operation and Maintenance Cost	Total
Multiple-Purpose Structure	86,540	2,180	88,720
Project Administration	8,400		8,400
GRAND TOTAL	94,940	2,180	97,120

1/ Price Base 1976.
2/ 100 years @ 6-1/8 percent interest.

Date: June 1976

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Great Creek Watershed, Virginia

Dollars 1/

Item	Estimated Average Annual Damage Without Project	With Project	Damage Reduction Benefits
Floodwater			
Crops and Pasture	1,320	750	570
Other Agricultural	5,300	1,870	3,430
Urban Commercial	17,890	240	17,650
Roads and Bridges	4,780	290	4,490
Subtotal	29,290	3,150	26,140
Sediment			
Overbank Deposition	640	260	380
Downstream Reservoirs and Channels	37,430	18,430	19,000
Subtotal	38,070	18,690	19,380
Indirect	13,370	3,810	9,560
TOTAL	80,730	25,650	55,080

1/ Price Base: 1976 Current Normalized Prices for agricultural values. Current prices for all other values.

Date: June 1976

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Great Creek Watershed, Virginia

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 3/	Benefit Cost Ratio
	Damage 2/ Reduction	More Intensive Land Use Agr.	Changed Land Use Agr.	Municipal Water Supply	Incidental Recreation	Local Secondary	Total		
Multiple-Purpose Structure	50,160	14,260	8,250	44,870	8,530	17,400	143,470	88,720	1.6:1.0
Project Administration	xxx	xxx	xxx	xxx	xxx	xxx	xxx	8,400	
GRAND TOTAL	50,160	14,260	8,250	44,870	8,530	17,400	143,470	97,120	1.5:1.0

1/ Price Base: Costs 1976; Agricultural values, 1976 Current Normalized Prices; all other values current (1976) prices.

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $4,920 annually.

3/ From Table 4.

Date: June 1976

FINAL PLAN

AND

FINAL ENVIRONMENTAL IMPACT STATEMENT

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended and in Accordance with the National Environmental Policy Act (Public Law 190, 91st Congress, 83 Stat. 853, Section 102(2)(C)).

Prepared by:

Southside Soil and Water Conservation District
Brunswick County Board of Supervisors
Town of Lawrenceville
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service in cooperation with the Virginia Division of Forestry

April 1976

460852

TABLE OF CONTENTS

Part I Draft Plan

Part II Environmental Impact Statement

TABLE OF CONTENTS

TABLE OF CONTENTS

ACKNOWLEDGMENTS

Agencies listed below provided reports or other assistance during the development of this watershed work plan:

United States Army, Corps of Engineers
United States Department of Agriculture
  Agricultural Stabilization and Conservation Service
  Statistical Reporting Service
United States Department of Commerce
  Bureau of the Census
  National Weather Service
United States Department of the Interior
  Fish and Wildlife Service
  Geological Survey
  National Park Service
United States Environmental Protection Agency
Cooperative Extension Service
Virginia State Water Control Board
Virginia Commission of Game and Inland Fisheries
Virginia Department of Highways and Transportation
Virginia State Archeologist
Virginia Historical Landmarks Commission
Virginia Soil and Water Conservation Commission
Virginia Division of State Planning and Community Affairs

These and many other public agencies, private groups, and individuals rendered valuable services in the preparation of this work plan. Their contributions are appreciated and gratefully acknowledged.

PART I

FINAL PLAN

GREAT CREEK WATERSHED

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

WATERSHED PLAN AGREEMENT

between the

Southside Soil and Water Conservation District

Brunswick County Board of Supervisors

Town of Lawrenceville

(hereinafter referred to as the Sponsoring Local Organization)

State of Virginia

and the

Soil Conservation Service
United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Great Creek Watershed, State of Virginia, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Great Creek Watershed, State of Virginia, hereinafter referred to as the watershed plan, of which this agreement is a part;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed plan, and further agree that the works of improvement as set forth in said plan can be installed in about five (5) years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed plan:

1. Brunswick County will acquire, with other than P.L. 566 funds, such landrights as will be needed in connection with the works of improvement (Estimated cost $118,800).

2. The sponsoring local organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsoring local organization and the Service as follows:

	Brunswick County (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	22.0	78.0	0 1/

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. Brunswick County will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Brunswick County (percent)	Service (percent)	Estimated Construction Costs (dollars)
Multiple-purpose Structure No. 6A	8.0	92.0	1,114,100
Raw Water Intake	100	0	7,680

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Brunswick County (percent)	Service (percent)	Estimated Engineering Costs (dollars)
Multiple-purpose Structure No. 6A	8.0	92.0	50,690
Raw Water Intake	100	0	1,150

6. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be $10,005 and $115,045, respectively.

7. The Southside Soil and Water Conservation District will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation plans on their land.

8. The Southside Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed plan.

9. The Southside Soil and Water Conservation District will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. Brunswick County will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed plan is contingent on the availability of appropriations for this purpose.

    A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Southside Soil & Water Cons. District
Local Organization

By /s/ Wm. F. Vaughan

Title Chairman

Chase City, Va. 23924
Address Zip Code

Date 5-13-76

The signing of this agreement was authorized by a resolution of the governing body of the Southside Soil and Water Conservation District
Local Organization
adopted at a meeting held on 1-15-76

/s/ Richard W. Lachs
Secretary, Local Organization

Kenbridge, Va. 23944
Address Zip Code

Date 5-13-76

Brunswick County Board of Supervisors
Local Organization

By /s/ S. J. Brandon

Title Chairman

Lawrenceville, Va. 23868
Address Zip Code

Date 5-14-76

The signing of this agreement was authorized by a resolution of the governing body of Brunswick County, Virginia
Local Organization
adopted at a meeting held on Feb. 18, 1976

/s/ Jesse L. Fowler
Secretary, Local Organization

P. O. Box 13, Lawrenceville, Va.
Address Zip Code 23868

Date May 14, 1976

Town of Lawrenceville
Local Organization

By /s/ E. Norborne Doyle, Jr.

Title Mayor

Lawrenceville, Va. 23868
Address Zip Code

Date May 14, 1976

The signing of this agreement was authorized by a resolution of the governing body of the Town of Lawrenceville
Local Organization
adopted at a meeting held on April 13, 1976

/s/ Mable E. Brewer
Secretary, Local Organization
Clerk

101 E. Church St.
Lawrenceville, Va. 23868
Address Zip Code

Date May 14, 1976

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

/s/ D. N. Grimwood
State Conservationist

May 14, 1976
Date

WATERSHED PLAN

GREAT CREEK WATERSHED

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

April 1976

SUMMARY OF PLAN

This plan was prepared by the Southside Soil and Water Conservation District, Brunswick County Board of Supervisors, and the town of Lawrenceville, the sponsoring local organizations.

The portion of Great Creek watershed contained in the project area drains approximately 29,754 acres in Brunswick and Lunenburg Counties, Virginia. Due to the flood hazard, the use and management of large areas of the flood plain lands of Great Creek for agricultural production are severely limited. When not subject to flooding, soils of the flood plain respond well to improved agricultural management practices, produce high yields, and are less subject to erosion than uplands. Other problems caused by the flooding include damage to urban areas of Lawrenceville, highways, public utilities, farm improvements, erosion of the uplands, and sedimentation of the bottom lands. Economic growth and personal income in the area are being restricted by an inadequate municipal water supply system. Average annual damages, including downstream sedimentation originating in the watershed, are estimated to be $68,255.

Resource inventories and evaluations will be made and land treatment measures will be installed on 800 acres of cropland, 625 acres of pastureland, 33 acres of other open lands, and 6,980 acres of forest land. Planned land treatment measures include wildlife habitat management on 15 acres.

Property owners in Brunswick County and the town of Lawrenceville are eligible for flood insurance on the flood plain area downstream from the proposed structure.

It is estimated that the project can be installed in 5 years at a total cost of $1,639,600. Public Law 566 funds will provide $1,279,450 and others $360,150 of this cost. Land treatment measures are estimated to cost $222,130, with Public Law 566 funds providing $92,800 for accelerated technical assistance for land treatment and soil surveys and other funds providing $129,330 for installation costs and the technical assistance. In recent years, landowners and operators have installed land treatment measures similar to the measures proposed in this plan at an estimated cost of $283,790. The multiple-purpose dam is estimated to cost $1,417,470; Public Law 566 funds will provide $1,186,650 and other funds $230,820. Of the amount supplied from

other funds, $118,800 represents landrights costs, $102,015 represents engineering services and construction costs, and $10,005 for project administration costs.

The Southside Soil and Water Conservation District will coordinate installation of this project and will execute agreements with landowners or operators for installation of land treatment measures. These land treatment measures will be installed by owners and operators within the watershed. The Soil Conservation Service and the Virginia Division of Forestry, through cooperative programs with the U.S. Forest Service, will provide technical assistance as needed.

Brunswick County will secure the necessary land and water rights, and will provide the nonfederal share of the installation funds for the structure as set forth in the Watershed Plan Agreement. In securing the landrights, the county will meet the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

Brunswick County intends to request the Soil Conservation Service to prepare the design and layout for the multiple-purpose structure in accordance with applicable laws and Soil Conservation Service policy. In connection with project administration, the county will provide inspection services required for the water supply features and those it deems necessary for flood prevention features of the project, provide the clerical and administrative services it requires, and bear the cost it incurs. In addition, the county will, at its expense, provide sanitary facilities, access roads, and parking to be used for recreational purposes at the structure site.

The Soil Conservation Service will administer construction contracts, provide inspection services deemed necessary on all items of construction on which P.L. 566 funds are spent and any other items of construction which may affect the function or stability of the structure, provide the clerical, administrative and related services the above items require, and bear the costs it incurs.

Operation and maintenance of the dam will be performed by Brunswick County at an average estimated cost of $2,000 annually. Land treatment measures will be maintained by the landowners and operators through agreements with the Southside Soil and Water Conservation District.

Acceleration of land treatment measures and the installation of one multiple-purpose structure will control runoff from 87.6 percent of the watershed and will store sediment and floodwater. The area flooded by the 100-year frequency storm will be reduced by 141 acres; the 10-year storm by 131 acres; the 5-year storm by 151 acres, and the 2-year storm by 164 acres. This will directly affect the agricultural and forestry use of 450 acres of flood plain, roads and bridges, and 220 acres of urban land in and around Lawrenceville.

Average annual benefits from all planned structural measures are estimated at $120,535 (see tables 5 and 6). The average annual cost of structural measures is estimated at $89,050, resulting in a benefit cost ratio of 1.4 to 1.0.

All information and data, except as otherwise noted, were collected during watershed planning investigation by the Soil Conservation Service, U.S. Department of Agriculture. The Forest Service participated in plan development and provided inputs on project aspects related to forest land.

INTRODUCTION

This plan has been briefed to avoid excessive duplication with information required in the Environmental Impact Statement. Part II should be reviewed for additional information on problems, alternatives, environmental impacts, and use of resources.

PLANNED MEASURES

The Great Creek Watershed Plan consists of acceleration of land treatment measures needed to improve land cover conditions, and one multiple-purpose structure for storage of municipal and industrial water in addition to floodwater and sediment storage.

Land treatment measures are planned for 800 acres of cropland, 625 acres of pastureland, 6,980 acres of forest land, and 33 acres of other land. The Soil Conservation Service will complete soil surveys of 19,310 acres and provide accelerated technical assistance to landowners and operators in the planning and application of needed measures and land use changes. The Virginia Division of Forestry, in cooperation with the U.S. Forest Service, will provide accelerated technical assistance with the application of forestry measures.

Measures needed to achieve adequate treatment of cropland include conservation cropping system, contour farming, diversions, grassed waterways, drainage practices, cover and green manure crops, and minimum tillage. Pastureland measures include pasture management, brush management, pasture planting, and planned grazing systems. Forest land measures include insect and disease control, tree planting, hydrologic cultural operations, livestock exclusion, and skid trail and logging road erosion control.

The 33 acres in other uses consist of urban areas, wildlife areas, recreational developments and miscellaneous uses. No specific land treatment needs for these areas have been identified. Technical assistance will be provided on a site by site basis if needs should be identified in the future.

One multiple-purpose structure is proposed on the main stem of Great Creek, as shown on the project map. The structure will have a concrete principal spillway with a SAF stilling basin. The emergency spillway system will consist of a primary (concrete chute) spillway and a secondary (vegetated) spillway. The structure has a design life of 100 years. It will provide 10,000 acre-feet of flood storage and will control the runoff from 26,074 acres or 87.6 percent of the total watershed area. Storage capacity will be provided for the 100-year sediment accumulation (916 acre-feet) expected within the impoundment. The structure will also contain 950 acre-feet of municipal and industrial water supply storage for Brunswick County. The 950 acre-feet provided for this purpose includes allowances for evaporation and seepage losses, and for a guaranteed minimum downstream release rate equal to the 10-year, 7-day low flow of 0.17 m.g.d. A 12-inch slide gate will be installed 5 feet above the base of the riser. This gate, which is designed for flow management, will provide a means for releasing water from the lower part of the reservoir during wet periods. The water supply gates will serve the function of releasing water during drought periods in order to maintain the downstream release rate.

The appurtenant water supply features consist of three 12-inch slide gates installed in the riser. The water will be discharged to the stream and picked up at the raw water intake to the treatment plant about 2.7 miles downstream from the dam. The pumping station for the raw water intake, the water treatment plant, and the water distribution system are nonproject features.

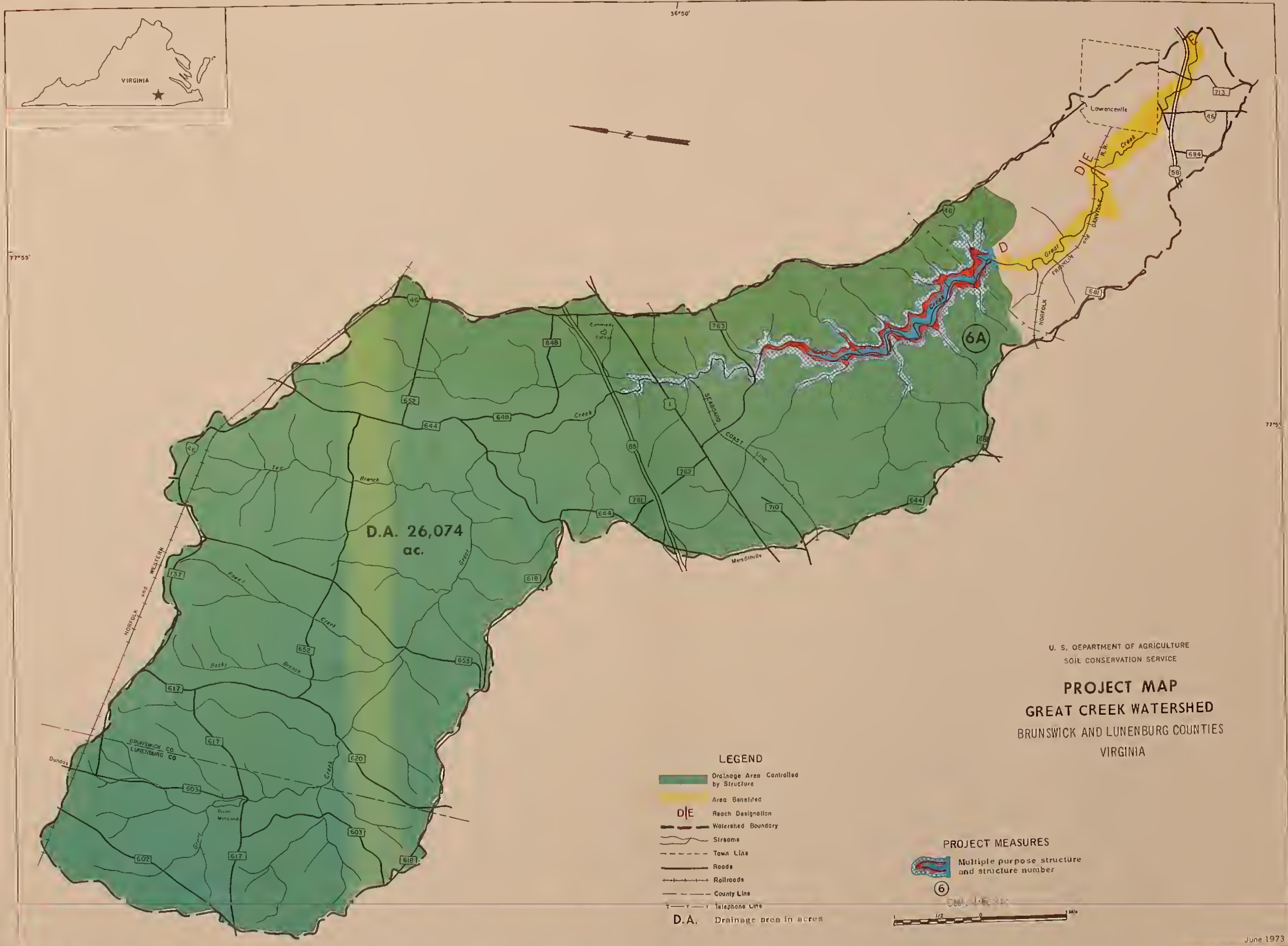
The 212-acre reservoir will be stocked with fish, public access will be provided and recreation and sanitary facilities will be installed by Brunswick County for incidental recreation and fishing use by the public.

Appropriate measures will be taken during construction to minimize soil erosion as well as water, air, and noise pollution. The plans and specifications for the structure will include erosion control measures such as sediment and debris basins, diversions, temporary stream crossings, dust suppressors, temporary vegetation, etc. The sequence of operations will also be specified in order to minimize the pollution hazard. Any solid or liquid wastes which might cause pollution will be handled in accordance with applicable state and local laws.

Installation of the dam will require the purchase of, or flowage easements on, a minimum of 719 acres of land; 212 acres in the sediment and water supply pools, 406 acres in the flood pool, 77 acres between the emergency spillway crest and design high water elevations, and 24 acres in the construction area.

According to the Virginia Historic Landmarks Commission and the Virginia State Archeologist there are no known sites of historical or archeological importance that would be affected by the installation of this project.

Both Brunswick County and the Town of Lawrenceville have qualified for flood insurance under the National Flood Insurance Program administered by the Department of Housing and Urban Development by adopting the necessary flood plain zoning ordinances. Engineering data developed while planning the Great Creek Watershed will be made available to these local governments for use in their flood plain management programs. See Appendix H.



SOURCE: Base map furnished by Field dated March 1973

INSTALLATION COSTS – MONETARY

Estimated project costs for both land treatment and structural measures are shown in Table 1. Structural measure cost estimates are shown in greater detail in Table 2. Allocation between purposes and sharing of estimated costs between P.L. 566 and other than P.L. 566 funds are shown in Table 2A. Cost-sharing percentages for structural measures shown in the Watershed Plan Agreement will be the basis for sharing actual costs incurred at the time of installation. These percentages are based upon the purposes involved, law and current policy.

LAND TREATMENT MEASURES

Estimated costs for land treatment measures, including technical assistance and installation costs shown in Table 1, are based on recent experiences in installation of similar measures. Technical assistance is required for soil surveys, resource inventories and evaluations, and planning for the accelerated installation of the needed conservation measures. Costs of technical assistance for the installation of forest land treatment measures are based on actual expenditures and accomplishments of the Virginia Division of Forestry. An analysis of costs against accomplishments was made for each measure to determine unit cost for technical assistance. Technical assistance, on lands undergoing development for other than agricultural uses, is designed to provide guidance to planning boards and individuals to minimize erosion, runoff, and other problems.

Acceleration of technical assistance to landowners for planning and application of land treatment measures and soil surveys will be required to accomplish the goals of the planned project within the five-year installation period. Approximately 25 percent of the needed soil surveys and planned measures can be accomplished by going programs; and accomplishment of the remaining 75 percent of these measures during the project installation period will be dependent on project funds in the form of accelerated planning and application assistance to landowners.

The total estimated costs are $222,130, which includes $104,830 for installation of the land treatment measures, and $117,300 for technical assistance. The Virginia Division of Forestry will use $4,500 of regular funds, services valued at $8,500 through the Cooperative Forest Management Program and $2,300 through the Cooperative Forest Fire Control Program, and $27,700 in PL 566 funds for accelerated technical assistance. The Soil Conservation Service will provide $9,200 from going program funds, the current level of technical assistance in this watershed. The Soil Conservation Service will also expend P.L. 566 funds in the amount of $29,400 for soil surveys and $35,700 to accelerate technical assistance in the installation of planned land treatment measures and land use changes.

STRUCTURAL MEASURES

Costs of the structure consist of construction, engineering services, and landrights costs. Project administration costs are estimated to be $125,050. Estimated costs for construction, engineering services, landrights, and project administration are based on recent experiences in the installation of similar measures under similar conditions.

Construction cost, which is the contract cost for structural measures, is based on bid-item schedules from preliminary designs and applicable unit prices from recent contract unit prices for similar work in Virginia. The construction cost is estimated to be $1,121,780 which includes a 12 percent contingency allowance to cover unusual items or changed conditions at the time of construction. Public Law 566 construction cost is estimated to be $1,024,970. The local cost is estimated to be $96,810, all of which will be paid by Brunswick County in order to incorporate 950 acre-feet of municipal and industrial water supply storage in the structure and to install the raw water intake system for the specific purpose of water supply.

Engineering services are estimated to cost $51,840, which includes the usual costs for surveys, design, preparation of plans and specifications, and geologic investigations. Public Law 566 Engineering Services costs are estimated at $46,635. Engineering Services costs for Brunswick County are estimated at $5,205, of which $1,150 is for the raw-water intake structure and $4,055 for participation in the multiple-purpose structure.

Landrights costs were estimated by the sponsors' landrights committee and include those fee simple titles and flowage easements necessary for the permanent pool and floodwater areas, emergency spillway, dam (including construction zone), and public access. The county will secure fee simple title to sufficient land to provide: 212 acres for the water supply pool, 24 acres for the dam and spillway, and access to the water supply pool at all stages. Easements will be obtained on another 483 acres between the water supply pool and design high water elevations. The landrights costs are estimated at $118,800, of which $3,000 is the estimated cost of relocating a stream gage now in the flood pool area of the proposed site.

Project administration costs include the cost of contract administration, review of engineering plans prepared by others, Government representative, liaison between the Contracting Officer and contractor, inspection service during construction, clerical, and other miscellaneous expenses. These costs to the sponsors and the Soil Conservation Service are estimated to be $10,005 and $115,045, respectively. The sponsors' estimated project administration costs include contract administration, inspection services, and clerical and other administrative services they provide. The Soil Conservation Service will assist the sponsors in providing these services and bear the cost incurred.

The joint construction, engineering, and landrights costs for the dam are allocated between the purposes of flood prevention and municipal water supply on the basis of storage capacity provided for each purpose. The construction and engineering costs for the water supply gates are for the specific purpose of water supply and are allocated to that purpose.

On the basis of storage, 92.0 percent of the joint costs for the site are allocated to flood prevention and 8.0 percent to municipal water supply. The Soil Conservation Service will bear 92.0 percent of the joint construction costs of the dam and the county will provide 8.0 percent.

Brunswick County intends to request that the Service prepare the design and layout for the multiple-purpose structure, in accordance with accepted Soil Conservation Service policy. The county will pay 100 percent of the engineering costs associated with the water supply gates and 8.0 percent of the engineering services cost associated with the joint construction items. The Soil Conservation Service will bear 92.0 percent of the engineering services cost associated with the joint construction items of the dam.

Investigation has disclosed that under present conditions the project will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, sharing of relocation payments will be in a ratio of 22.0 percent sponsor cost and 78.0 percent Soil Conservation Service cost. The county will provide all funds for relocation assistance advisory services, should they become necessary.

The sponsors have established a 5-year project installation period in order to allow adequate time for installing all necessary land treatment measures. The estimated obligation of project funds, including land treatment and structural measures, for each fiscal year during the installation period is as follows:

	P.L. 566 Funds		Other Funds		
Year	Structural Measures	Land Treatment	Structural Measures	Land Treatment	Total
	$	$	$	$	$
1	63,890	21,680	125,505	25,840	236,915
2	1,059,485	21,680	99,810	25,890	1,206,865
3	34,513	21,680	3,005	25,865	85,063
4	17,257	15,080	1,500	25,870	59,707
5	11,505	12,680	1,000	25,865	51,050
	1,186,650	92,800	230,820	129,330	1,639,600

BENEFITS – MONETARY

The average annual value of benefits from structural measures and land treatment is estimated to be $124,690. The average annual floodwater and sediment damage reduction benefits will amount to $46,550. Of these benefits, $4,155 will result from land treatment measures and $42,395 from the structural measures.

The structure selected during project formulation will provide a high degree of control at the town of Lawrenceville and to a major portion of the flood plain. Damage by the 100-year frequency storm to existing flood plain improvements at Lawrenceville will be limited to the access roads and grounds. Tables 5 and 6 give details of the project benefits.

Average annual floodwater damage reduction benefits to crops and pasture will total $520. Other agricultural benefits amount to $2,900 and result from reduction of damages to farm roads, fences, and other similar improvements. Reduction of damages to highways and bridges amount to $3,790 annually. Reduction of damages to urban commercial properties and public utilities at Lawrenceville are estimated to be $14,900.

Sediment and erosion damage reduction benefits have been estimated to average $16,370 annually, of which $325 will be from reduced overbank deposition, and $16,045 from reduced sediment damages downstream in the Emporia Dam, a municipal water supply reservoir.

Indirect benefits will amount to $8,070 annually. These will result from reduction of such items as power failures, late feed deliveries, delayed marketing, loss of work, interrupted public services, increased expenses of detouring traffic, and other such losses associated with floodwater, sediment, and erosion damages.

Flood protection provided by this project will make it possible for landowners to use their flood plain and some adjacent lands more effectively and intensively. Farm operators will have more freedom in selecting proper soil type and slope conditions for their various crops. Use of larger amounts of higher analysis fertilizer, improved seed varieties, and other improved management practices will be more economical. More intensive use and changed land use benefits on agricultural land have been estimated at $18,285 annually, after allowing for the associated costs for development and production.

From information provided by consulting engineers retained by Brunswick County, benefits to municipal water storage will amount to $37,890 annually, based on alternative development costs.

Local secondary benefits resulting from the project are estimated to total $14,765 annually. Of these benefits, $5,300 annually is considered induced by the project and will result from increased

local income and other returns to local suppliers from expenditures directly associated with the production and marketing of agricultural products. Other local secondary benefits stemming from the project will result from greater use of transportation, processing, and marketing facilities. Local economic development due to the expansion of the municipal water system and increased use of the area's utilities and service will increase both agricultural and general business activities. These benefits will amount to $9,465 annually. Use of the impoundment for boat and bank fishing will produce net incidental recreation benefits estimated at $7,200 annually.

The proposed forest land treatment measures will improve the hydrologic condition of the forest land. This will reduce sediment and retard storm runoff. Also, proper management and continued fire protection will increase the productivity of the forest land on the watershed.

Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation of this project.

COMPARISON OF BENEFITS AND COSTS

Average annual cost of structural measures has been estimated at $89,050. Annual primary net benefits from planned structural measures, not including local secondary benefits, have been estimated at $105,770, giving a benefit-cost ratio of 1.2 to 1.0. Inclusion of local secondary benefits increases the estimated average annual benefits to $120,535 and the benefit-cost ratio to 1.4 to 1.0. Table 6 summarizes the annual benefits and costs.

INSTALLATION PROVISIONS

The Southside Soil and Water Conservation District, the Brunswick County Board of Supervisors, and the Town of Lawrenceville, are the Sponsoring Local Organizations, and will be responsible for the successful application of this watershed plan. Their responsibilities will be established by memoranda of understanding and cooperative agreements with other agencies, individuals, and organizations.

An installation period of 5 years has been established for the measures proposed in this work plan. Land treatment measures will be installed more or less uniformly over the entire project installation period. It is anticipated that structure design will be prepared the first year; construction begun in the second year and substantially completed during the third year; and minor items and

final project administration activities will be completed in the fourth and fifth years.

LAND TREATMENT MEASURES

The Southside Soil and Water Conservation District will coordinate installation of the land treatment measures proposed in this watershed plan. This responsibility is defined in memoranda of understanding and cooperative agreements with other agencies, organizations, and individuals.

Landowners and operators will be encouraged to apply and maintain the needed measures and treatment recommended for their lands. The Soil Conservation Service will complete soil surveys of 19,310 acres and will provide accelerated and going program technical assistance to landowners and operators in the planning and application of needed measures and land use changes. The forest land treatment measures will be installed by the landowners with accelerated and going program technical assistance furnished by the Virginia Division of Forestry in cooperation with the U.S. Forest Service.

STRUCTURAL MEASURES

The structural works of improvement consist of one multiple-purpose structure for floodwater, sediment, and municipal water storage. Brunswick County will be responsible for the sponsor's share of the construction cost. The county will also purchase the construction site, and the pool area to the elevation of the municipal water storage. They will either purchase or obtain flowage easements on the flood pool area and also on that area up to the maximum reservoir elevation attained during passage of the emergency spillway hydrograph, an elevation 3.5 feet above the primary emergency spillway crest. The county has the right of eminent domain and agrees to use this authority if necessary in securing the required landrights.

Investigation has revealed that no persons, businesses, or farm operations will be displaced by the installation of this project. However, in securing the landrights, the county will meet the applicable requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. If relocations become necessary, the county will provide without P.L. 566 financial assistance relocation assistance advisory services. Relocation payments will be cost-shared in accordance with percentages shown in the Watershed Plan Agreement. An appraisal of the fair market value of the real property to be acquired will be made by a qualified land appraiser prior to negotiation of a purchase contract.

Brunswick County intends to request that the Soil Conservation Service provide technical services including surveys, investigations, design, and preparation of plans and specifications for the multipurpose structure.

The Soil Conservation Service will, at P.L. 566 cost, provide construction inspection for all items on which P.L. 566 funds are spent. The Soil Conservation Service will also inspect other items of work where failure to operate as planned could adversely affect the stability or functioning of these cost-shared items of work.

Brunswick County will provide inspection services deemed necessary to assure that the water supply features will meet contract requirements and function properly. The county intends to request the Soil Conservation Service to let and administer construction contracts. The raw water intake system, which is a nonproject feature, will be installed by Brunswick County.

The sponsors have presented satisfactory assurances that at least fifty percent of the land above the retention reservoir will be under conservation agreements before construction is initiated.

Both Brunswick County and the town of Lawrenceville, two of the sponsors, have adopted the necessary zoning ordinances for participation in the National Flood Insurance Program. The Service has established present and future flood profiles for the 100-year frequency flood and also for the major flood of October 1972. This information will be made available to the sponsors for use in their flood plain management program.

In order to assure public access to the 212-acre lake for fishing and other incidental recreation, the county has agreed to secure permanent landrights for an access road from State Highway 46 to the reservoir site. This will be used initially for construction purposes and afterwards for access for recreation purposes. The county will in addition purchase in fee simple title five acres on the east bank for parking, boat launching, bank fishing and sanitary facilities. Also, the county will purchase a 50-foot strip around the perimeter of the permanent pool for bank fishing and other recreational activities. Responsibility for installing, operating, and maintaining the recreational facilities in accordance with applicable state and local health rules and regulations will be assumed by Brunswick County.

OPERATION AND MAINTENANCE PROVISIONS

Land treatment measures will be operated and maintained by landowners and operators through cooperative agreements with the Southside Soil and Water Conservation District.

Brunswick County will be responsible for operation and maintenance of the multiple-purpose structure at an estimated cost of $2,000 annually. The Virginia Commission of Game and Inland Fisheries will stock the reservoir with largemouth bass, bluegill, redear sunfish, channel catfish, and possibly other game fish. Brunswick County will provide a public access road to the site. Resources and facilities provided for public fishing will be operated, maintained, and replaced as necessary by the county. The county will also operate and maintain modern sanitary facilities as required by state and local health laws and regulations to allow full use of the municipal water supply pool for fishing and other incidental recreation. In addition, the county will be responsible for the repair and replacement of recreation equipment and facilities when needed. The county will seek assistance from the Virginia Commission of Game and Inland Fisheries in maintaining the fishery and to improve, protect, and preserve wildlife resources of the reservoir and surrounding county owned land. Funds for operation and maintenance of the fishery resources and facilities provided for public recreation will be obtained from user fees, not to exceed that amount required to defray operation and maintenance costs and to recover the county's initial investment.

Typical operation items will include the operation of gates for water supply and flow management, the removal of trash and debris from the pools and structure after floods, the development and enforcement of regulations for use of recreational facilities, the restriction of motor vehicles to designated roads and parking areas, the prevention of pollution to water used for public consumption and/or recreation, the timely disposal of garbage and other refuse, and the elimination of safety hazards.

Typical vegetative maintenance items will include mowing, fertilizing, reseeding, weed control, and grazing control for vegetated areas. Maintenance of the earth dam may include replacement and revegetation of eroded areas in the earth spillway or on the dam itself, inspection and clean-out of drainage systems, and replacement of rock riprap as needed. Maintenance of appurtenant structures may include removal of debris from the trash racks and impact basin, maintenance of gates and valves, repainting of all surfaces requiring protection by paint, maintenance of recreational features, and repairing or replacing signs as needed.

Designated representatives of the Soil Conservation Service and the sponsors will jointly make an inspection annually, after severe floods and after the occurrence of any other unusual conditions that might adversely affect the structure. These inspections will continue for three years following installation of the dam. Inspections after the third year will be made by the sponsors. They will prepare a report, and furnish a copy to the Soil Conservation Service employee responsible for the inspection follow-up activities. These reports will be thoroughly reviewed by the Soil Conservation Service representative. Any evidence of needed inspections, or maintenance not being performed properly, will be reported immediately and appropriate action taken by the responsible sponsor.

Specific operation and maintenance agreements will be executed prior to signing a landrights, relocation, or project agreement. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with P.L. 566 financial assistance. The operation and maintenance agreements will contain a reference to the Virginia Operation and Maintenance Handbook and an operation and maintenance plan will be prepared for each structural measure.

FINANCING PROJECT

The estimated $104,830 in costs for application of land treatment will be from the resources of landowners and operators with the cost-sharing assistance available under established conservation programs.

Technical assistance now available through going conservation programs will be continued at about the same rate that existed prior to the development of this plan. This cost has been estimated at $24,500. The Soil Conservation Service will use $9,200 from regular program funds, and the Virginia Division of Forestry will use $4,500 of regular funds, services valued at $8,500 through the Cooperative Forest Management Program and $2,300 through the Cooperative Forest Fire Control Program. The costs for accelerated technical assistance, which includes soil surveys, have been estimated at $92,800 and will be financed from P.L. 566 funds. Of this amount, the U.S. Forest Service will use $27,700 in cooperation with the Virginia Division of Forestry. The Soil Conservation Service will use $65,100.

Brunswick County will provide the nonfederal share of the project costs for the structural measure; estimated at $230,820, from its regular sources of revenue. This includes landrights valued at $118,800, and the costs for municipal water supply which are not eligible for P.L. 566 cost-sharing. The county has analyzed the installation schedule and its financial needs and has determined that local funds will be available from their regular sources of income at the time and in the amounts needed.

Investigation has disclosed that, under present conditions, the project measures will not result in the displacement of any person, business or farm operation. However, if relocations become necessary, relocation assistance advisory services and relocation assistance will be provided by Brunswick County. Relocation payments will be cost-shared between the county and the Soil Conservation Service in accordance with the percentages shown in the Watershed Plan Agreement. County funds, if needed, will come from local appropriations.

This watershed plan does not constitute a financial document to serve as a basis for obligation of federal funds. Financial or other assistance to be furnished by the Soil Conservation Service, Forest Service, or the Virginia Division of Forestry in carrying out this watershed plan is contingent upon appropriation of funds for this purpose.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Great Creek Watershed, Virginia

Installation Cost Item	Unit	Number Non-Fed. Land	Number Total	Estimated Cost (Dollars) 1/ P. L. 566 Funds Non-Federal Land SCS 2/	P. L. 566 Funds FS 2/	P. L. 566 Funds Total	Other Non-Federal Land SCS 2/	Other FS 2/	Other Total	TOTAL
LAND TREATMENT										
Land Areas 3/	Acres									
Cropland	to be	800	800				9,425		9,425	9,425
Pastureland	Treated	625	625				32,675		32,675	32,675
Forest Land		6,980	6,980					54,400	54,400	54,400
Other		33	33				8,330		8,330	8,330
Technical Assistance				65,100	27,700	92,800	9,200	15,300*	24,500	117,300
TOTAL LAND TREATMENT	xxx	xxx	xxx	65,100	27,700	92,800	59,630	69,700	129,330	222,130
STRUCTURAL MEASURES										
Construction										
Multiple-Purpose Structure 6A	No.	1	1	1,024,970		1,024,970	89,130		89,130	1,114,100
Raw Water Intake							7,680		7,680	7,680
Subtotal - Construction				1,024,970		1,024,970	96,810		96,810	1,121,780
Engineering Services				46,635		46,635	5,205		5,205	51,840
Project Administration										
Construction Inspection				52,790		52,790	4,590		4,590	57,380
Other				62,255		62,255	5,415		5,415	67,670
Subtotal - Administration				115,045		115,045	10,005		10,005	125,050
Other Costs										
Landrights							118,800		118,800	118,800
Subtotal - Other							118,800		118,800	118,800
TOTAL STRUCTURAL MEASURES				1,186,650		1,186,650	230,820		230,820	1,417,470
TOTAL PROJECT				1,251,750	27,700	1,279,450	290,450	69,700	360,150	1,639,600

* Includes $8,500 from Cooperative Forest Management Program and $2,300 from Cooperative Forest Fire Control Program.

1/ Price base 1974.

2/ Federal agency responsible for assisting in installation of works of improvement.

3/ Includes only areas estimated to be adequately treated or protected during the project installation period. Treatment will be accelerated throughout the watershed and dollar amounts apply to total land areas, not just adequately treated areas.

Date: April 1976

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Great Creek Watershed, Virginia

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
Land Treatment			
Conservation Cropping System	acres	2,000	8,000
Crop Residue Management	acres	1,300	5,200
Diversion	feet	1,500	750
Drainage	feet	2,500	1,250
Field Border	feet	6,000	900
Grassed Waterway or Outlet	acres	66	16,500
Land Smoothing	acres	125	6,250
Minimum Tillage	acres	100	100
Pasture & Hayland Management	acres	1,600	48,000
Pasture & Hayland Planting	acres	1,100	77,000
Recreation Area Improvement	acres	4	240
Spring Development	number	2	300
Stripcropping	acres	310	3,100
Terrace, Gradient	feet	13,000	5,200
Wildlife Upland Habitat Management	acres	30	2,250
Critical Area Planting	acres	15	3,750
Pond	number	100	50,000
Disposal Lagoon	number	4	2,000
Contour Farming	acres	200	800
Subtotal SCS			231,590
Forest Service			
Tree Planting	acres	1,720	34,400
Hydrologic Cultural Operations	acres	4,080	17,800
Subtotal F.S.			52,200
TOTAL			283,790

1/ Price Base: 1974.

Date: April 1976

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Great Creek Watershed, Virginia

(Dollars) 1/

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds				Total Inst. Cost
	Construction	Engineering 2/	Total P. L. 566	Construction	Engineering 2/	Land Rights 3/	Total Other	
Multiple-Purpose Structure	1,024,970	46,635	1,071,605	89,130	4,055	118,800	211,985	1,283,590
Raw Water Intake				7,680	1,150		8,830	8,830
Subtotal	1,024,970	46,635	1,071,605	96,810	5,205	118,800	220,815	1,292,420
Project Administration	xxx	xxx	115,045	xxx	xxx	xxx	10,005	125,050
GRAND TOTAL	1,024,970	46,635	1,186,650	96,810	5,205	118,800	230,820	1,417,470

1/ Price base 1974.
2/ Engineering contract costs to be borne $25,620 by P.L. 566 funds and $2,230 by Other Funds.
3/ Includes $2,000 for survey, legal fees and other costs.

Date: April 1976

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Great Creek Watershed, Virginia

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING					
	Purpose			P. L. 566			Other		
	Flood Prev.	Municipal Water Supply	Total	Flood Prev.	Municipal Water Supply	Total	Flood Prev.	Municipal Water Supply	Total
Multiple-Purpose Structure No. 6A	1,180,903	102,687	1,283,590	1,071,605		1,071,605	109,298	102,687	211,985
Raw Water Intake		8,830	8,830					8,830	8,830
GRAND TOTAL	1,180,903	111,517	1,292,420	1,071,605		1,071,605	109,298	111,517	220,815

1/ Price Base 1974.

Date: April 1976

TABLE 3 - STRUCTURAL DATA

STRUCTURES WITH PLANNED STORAGE CAPACITY

Great Creek Watershed, Virginia

ITEM	UNIT	Structure No. 6-A	TOTAL
Class of Structure		c	xxx
Drainage Area (Total)	Sq.Mi.	40.74	40.74
Curve No. (1-day) (AMC II)		63.	xxx
Elevation Top of Dam	Ft.	250.2	xxx
El. Cr. of Primary (Conc) Em.Sp.	Ft.	238.6	xxx
El. Cr. of Secondary (Veg) Em.Sp.	Ft.	245.3	xxx
Elevation Crest Principal Spillway	Ft.	213.2	xxx
Maximum Height of Dam	Ft.	57.0	xxx
Volume of Fill	Cu.Yds.	221,400	221,400
Total Capacity 1/	Ac.Ft.	11,866	11,866
Sediment Submerged	Ac.Ft.	859	859
Sediment Aerated	Ac.Ft.	57	57
Beneficial Use (W.S.)	Ac.Ft.	950	950
Retarding	Ac.Ft.	10,000	10,000
Surface Area			xxx
Sediment pool 2/	Ac.	(136)	(136)
Beneficial use pool (W.S.)	Ac.	212	212
Retarding pool 1/	Ac.	618	618
Principal Spillway Design			xxx
Rainfall Volume (areal) (1 day)	In.	7.53	xxx
Rainfall Volume (areal) (10 day)	In.	13.19	xxx
Runoff Volume (10 day)	In.	4.87	xxx
Capacity of Principal Spillway	cfs.	784	xxx
Frequency operation-Emer.Spillway	% chance	<1	xxx
Dimensions of Conduit	Ft.	5.9 x 4.4 (HxW)	xxx
Emergency Spillway Design			xxx
Rainfall Volume (ESH)(areal)3/	In.	13.0	xxx
Runoff Volume (ESH)	In.	7.90	xxx
Storm Duration	Hrs.	13.0	xxx
Dim. of Box Inlet Conc. Chute	Ft.	61 x 185 (BxW)	xxx
Bottom Width of Veg. Spillway	Ft.	475	xxx
Velocity of flow (V_e)	Ft./Sec.	8.7	xxx
Slope of exit channel	Ft./Ft.	0.025	xxx
Max. reservoir water surface elev.	Ft.	242.1	xxx
Freeboard Design			xxx
Rainfall Volume (FH)(areal) 3/	In.	31.3	xxx
Runoff Volume (FH)	In.	25.22	xxx
Storm Duration	Hrs.	13.0	xxx
Max. reservoir water surface elev.	Ft.	250.2	xxx
Capacity Equivalents			
Sediment Volume	In.	0.42	xxx
Retarding Volume	In.	4.60	xxx
Beneficial Volume	In.	0.44	xxx

1/ Crest of Emergency Spillway.
2/ Sediment pool only.
3/ Rainfall amounts adjusted for both drainage area and storm duration.

Date April 1976

TABLE 4 - ANNUAL COST

Great Creek Watershed, Virginia

(Dollars) 1/

Evaluation Unit	Amortization of 2/ Installation Cost	Operation and Maintenance Cost	Total
Multiple-Purpose Structure	79,370	2,000	81,370
Project Administration	7,680	: : : : : : : :	7,680
GRAND TOTAL	87,050	2,000	89,050

1/ Price Base 1974.
2/ 100 years @ 6-1/8 percent interest.

Date: April 1976

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Great Creek Watershed, Virginia

Dollars 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefits
	Without Project	With Project	
Floodwater			
Crops and Pasture	1,200	680	520
Other Agricultural	4,480	1,580	2,900
Urban Commercial	15,015	205	14,900
Roads and Bridges	4,035	245	3,790
Subtotal	24,820	2,710	22,110
Sediment			
Overbank Deposition	540	215	325
Downstream Reservoirs and Channels	31,605	15,560	16,045
Subtotal	32,145	15,775	16,370
Indirect	11,290	3,220	8,070
TOTAL	68,255	21,705	46,550

1/ Price Base: 1974 Current Normalized Prices for agricultural values. Current prices for all other values.

Date: April 1976

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Great Creek Watershed, Virginia

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 3/	Benefit Cost Ratio
	Damage 2/ Reduction	More Intensive Land Use Agr.	Changed Land Use Agr.	Municipal Water Supply	Incidental Recreation	Local Secondary	Total		
Multiple-Purpose Structure	42,395	10,785	7,500	37,890	7,200	14,765	120,535	81,370	1.5:1.0
Project Administration								7,680	
GRAND TOTAL	42,395	10,785	7,500	37,890	7,200	14,765	120,535	89,050	1.4:1.0

1/ Price Base: Costs 1974; Agricultural values, 1974 Current Normalized Prices; all other values current (1974) prices.

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $4,155 annually.

3/ From Table 4.

Date: April 1976

PRINCIPLES AND STANDARDS PHASE-IN ADDENDUM

GREAT CREEK WATERSHED PLAN

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

INTRODUCTION

This addendum was developed in accordance with phase-in procedures adopted by the Water Resources Council for level C studies for which field studies, analyses, and evaluations were completed as of October 25, 1973, and which were formulated in accordance with Senate Document 97 as supplemented and amended.

DISCOUNT RATE COMPARISON

Using an interest rate of 6-1/8 percent, average annual cost of structural measures has been estimated at $89,050. Annual primary net benefits from planned structural measures, not including local secondary benefits, have been estimated at $105,770, giving a benefit-cost ratio of 1.2 to 1.0. Incidental recreation benefits are based upon values outlined in Senate Document 97. Inclusion of local secondary benefits increases the estimated average annual benefits to $120,535 and the benefit-cost ratio to 1.4 to 1.0.

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

ENVIRONMENTAL CONCERNS

The major environmental concerns in this watershed are maintaining and improving:

1. areas of natural beauty
2. quality of water, land, and air
3. biological resources and ecological systems
4. geological, archeological, and historical resources

Great Creek watershed, to the lower end of the project area, consists of 29,754 acres located in Brunswick and Lunenburg Counties, Virginia. The stream flows generally in a southeasterly direction into the Meherrin River, a tributary of the Chowan River. The topography of the watershed is classified as rolling and is typical of the lower Piedmont Physiographic Province. The interspersion of pastureland, cropland, and forest land portrays a pleasant rural environment.

The slope of flood plain cropland ranges from 1 to 5 percent and produces an average of 3.5 tons of gross erosion per acre per year. Upland cropping areas range from 5 to 20 percent slope and average 16.3 tons of gross erosion per acre per year. When properly managed, erosion from pastureland is less than 4 tons per acre annually. Interviews with the local people indicate that the natural productive capacity of 1 acre of well-managed flood plain cropland is at least equal to 2 acres of well-managed upland cropland.

At the present time, sediment reduces the stream channel capacity, pollutes the water, and prevents sunlight from reaching aquatic plants growing in the water. This affects the quality of the water for human consumption and prevents development of habitat for aquatic ecosystems. The estimated sediment yield at the mouth of the watershed under present conditions is approximately 19,899 tons per year. This results in a sediment concentration of 600 mg/l.

At present, Great Creek provides little or no fishing. There is a need for more open water in the vicinity to furnish fishing and other recreational opportunities to the public. There is a variety of land use and plant and wildlife species within the watershed. There is a concern to maintain and protect this diversity of species and productivity of habitat. There are no threatened or endangered species within the watershed.

A check and review of the National Register of Historic Places was conducted; no listing was found for the watershed area. The Virginia Historic Landmarks Commission was consulted and this investigation indicated that one late 18th century, or early 19th century, plantation complex is eligible for the National Register of Historic Places. The

State Archeologist has been consulted, and he states ..."there are no significant archeological remains in the affected area."

St. Paul's College, formerly St. Paul's Polytechnic Institute, at Lawrenceville, was founded in 1888. It was the third oldest Negro vocational and industrial school in the United States. St. Paul's is now a fully accredited college. It offers Bachelor of Arts and Bachelor of Science degrees. The Christianna Campus of Southside Virginia Community College, located near Alberta, is the community college for the county. These two colleges are of cultural and historical importance.

OBJECTIVES

The objectives are to maintain and enhance the quality of the watershed by (1) protecting its natural beauty, (2) protecting the land by reducing erosion and sediment losses, (3) enhancing the wildlife habitat, and (4) protecting places of historical value and any archeological finds.

COORDINATION AND FORMULATION

Coordination

Meetings with Sponsors and discussions with other interested individuals, groups, and agencies provided the input needed for formulation of this plan.

The Formulation Process

The land treatment phase used in the Environmental Quality Plan is the same as the accelerated land treatment in the selected plan. The structural measure used in the selected plan was considered. This measure would enhance the environment by providing sediment control, and control flooding below the structure. Also, it would provide 950 acre-feet of water storage and provide fishing for recreation. Opposing viewpoints showed that the structure and water supply pool would inundate 32 acres of cropland, 163 acres of forest land, and 17 acres of other land for a total of 212 acres. It was decided that the natural environment could be best preserved by leaving this measure out of the Environmental Quality Plan.

Other alternatives to the selected plan were considered. The best of these was the Land Treatment with Acquisition of Flood Plain Land and Flood Plain Properties. This alternative was not used due to lack of public acceptance of acquisition of the flood plain.

Flood plain zoning was adopted as part of the environmental quality plan. The flood plain needs to be zoned to prohibit further urban development.

Conclusions

This plan in its complete form includes flood plain zoning and accelerated land treatment.

THE ABBREVIATED ENVIRONMENTAL QUALITY PLAN

This plan includes two phases - accelerated land treatment and flood plain zoning.

The land treatment phase is identical with the land treatment phase of the selected plan. Much of the watershed land, through natural means and applied treatment, is now adequately protected to retard surface runoff and to keep erosion to an acceptable minimum. Technical assistance, now available through the Southside Soil and Water Conservation District, Virginia Cooperative Extension Service, and the Virginia Division of Forestry through cooperative programs with the U.S. Forest Service, with appropriate acceleration, would be needed to complete the plan. Each conservation and forest land plan would need to be reviewed, in some cases new plans developed, and necessary treatment planned. Assistance would be needed in application of this treatment and to maintain adequate cover now on the ground. Technical assistance would also be needed to develop and interpret soils and other resource information.

Through consultation with conservation district directors, community leaders, landowners, and representatives of the state and federal agencies, it was agreed that essential land treatment should be applied to 800 acres of cropland, 625 acres of pastureland, 33 acres of other open lands, and 6,980 acres of forest land.

Land treatment measures to be installed on 800 acres of cropland include conservation cropping system, contour farming, diversions, grassed waterways, drainage, cover and green manure crops, minimum tillage, and crop residue management.

Land treatment measures to be applied to 625 acres of pastureland would require pasture management, pasture planting, brush management, and may need planned grazing systems to keep an adequate cover on the soil.

Forest land treatment, with varying degrees of intensity, is planned on 6,980 acres. Fire prevention and insect and disease control is planned for the total acreage. Other practices aimed at reducing erosion and improving hydrologic cover conditions would include tree planting, timber stand improvement, protection from grazing, seeding grass, and constructing water diversion bars on skid trails and roads.

Planned land treatment measures include 15 acres of wildlife habitat management for specific sites. Wildlife habitat management practices are included in recommendations for all land uses applied by the individual landowners and/or operators.

The land treatment program would include soil surveys on 19,310 acres to determine the kind of soil and its physical and chemical characteristics. This survey would be used as a basis for developing alternatives for land use and conservation treatment with landowners and operators.

The time required to install the accelerated land treatment measures would be 5 years.

The county would zone the flood plain to prevent any further development within the limits of the 100-year flood plain. Land use changes in the area would be minor and the flood plain would remain in agricultural production, forest land, and industrial development which is already established.

IMPLEMENTATION

The costs for land treatment application would be borne by landowners and operators. Cost-sharing assistance is available through existing conservation programs. Technical assistance would be furnished by local, state, and federal agencies through their going program funds, plus P.L. 566 funds for necessary acceleration of conservation planning and application. Each agency would bear the project administration costs it would incur during project installation.

Costs for implementing the flood plain zoning ordinance would be borne by Brunswick County and by the town of Lawrenceville. They would have the responsibility of administering the ordinances in their respective area.

Cost Distribution

Cost Item	
Conservation land treatment	$104,830
Technical assistance	$117,300 1/
Total land treatment cost	$222,130
Flood plain zoning	$ 27,300 2/
Total Cost	$249,430

1/ Includes $29,400 needed for soil surveys.

2/ Includes $5,000 for establishing ordinances, and $22,300 for mapping the 100-year flood plain for implementing and enforcing ordinances.

EFFECTS AND IMPACTS

The land treatment program and zoning ordinances would preserve natural areas and enhance the quality of water, land, and air resources. The land treatment on 8,438 acres of watershed land would reduce erosion, retard runoff, and improve wildlife habitat. The gross erosion rate would be reduced from 4.2 to 3.4 tons per acre per year. The biological resources and ecological systems would be maintained. Historical places would be preserved and areas of geological and archeological importance would be protected.

Adverse effects of flooding would not be prevented. Scouring and sediment deposition would continue to occur but at a somewhat slower rate. The quality of surface runoff would be improved as a result of land treatment measures. However, the quantity of water available would not be adequate to meet present and future municipal and industrial demands.

DISPLAY ACCOUNTS FOR THE SELECTED PLAN

GREAT CREEK WATERSHED PROJECT

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

Selected Plan

Great Creek Watershed Project, Brunswick and Lunenburg Counties, Virginia

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Components	Measures of Effects 1/
Beneficial effects:	
A. The value to users of increased outputs of goods and services	
1. Flood prevention	$60,680
2. Municipal and Industrial water supply	37,890
3. Incidental Recreation	7,200
Total beneficial effects	$105,770

Components	Measures of Effects 1/
Adverse effects:	
A. The value of resources required for a plan	
1. Multiple-purpose reservoir and appurtenances	
Project Installation (Structural Measures)	$79,370
Project Administration	7,680
Operations, Maintenance,& Replacement	2,000
Total adverse effects	89,050
Net beneficial effects	$16,720

1/ Average annual values

Selected Plan

Great Creek Watershed Project, Brunswick and Lunenburg Counties, Virginia

REGIONAL DEVELOPMENT ACCOUNT

Components	Measures of effects 1/ Regional 2/	Rest of Nation
A. Income:		
Beneficial effects:		
1. The value of increased output of goods and services to users residing in the region		
a. Flood Prevention	$60,680	
b. Municipal & Industrial water supply	37,890	
c. Secondary	14,765	
d. Incidental Recreation	7,200	
Total beneficial effects	$120,535	

Components	Measures of effects 1/ Regional 2/	Rest of Nation
A. Income		
Adverse effects:		
1. The value of resources contributed from within the region to achieve the outputs		
a. Multiple-purpose reservoir and associated facilities		
Project Installation (Structural Measures)	$13,560	$65,810
Project Administration	615	7,065
Operations, Maintenance, and Replacement	2,000	
Total Adverse effects	16,175	72,875
Net beneficial effects	$104,360	-
Net Adverse Effects	-	-72,875

1/ Average annual values

2/ Watershed

Selected Plan

Great Creek Watershed Project, Brunswick and Lunenburg Counties, Virginia

REGIONAL DEVELOPMENT ACCOUNT

Components	Measure of effects	
	Regional	Rest of Nation
B. Employment		
Beneficial effects:		
1. Increase in the number and types of jobs		
a. Employment for project construction	Average of 8 semi-skilled jobs annually during installation	-
b. Employment for processing municipal water, providing for incidental recreational use of the reservoir, and operations, maintenance, and replacement of project measures.	5 permanent semi-skilled jobs annually	-

Components	Measures of effects	
	Regional	Rest of Nation
B. Employment		
Adverse effects:		
1. Decrease in number and types of jobs	None	
Net beneficial effects	5 permanent semi-skilled jobs annually	-
	Average of 8 semi-skilled jobs for 5 years	-

Selected Plan
Great Creek Watershed Project
Brunswick and Lunenburg Counties, Virginia
REGIONAL DEVELOPMENT ACCOUNT

Components	Measures of effects	
	Regional	Rest of Nation
C. Population Distribution		-
Beneficial effects	Creates 40 man-years semi-skilled employment opportunities during project installation and 5 permanent semi-skilled jobs in a rural area which has recorded a 20 percent decline in population since 1950.	
Adverse effects	None known	
Regional Economic Base and Stability		-
Beneficial effects	Creates 5 permanent semi-skilled jobs and 40 short-term semi-skilled jobs in an area where 25 percent of the families have annual incomes of less than $3,000.	

Selected Plan
Great Creek Watershed Project
Brunswick and Lunenburg Counties, Virginia
SOCIAL WELL-BEING ACCOUNT

Components	Measures of effects
Beneficial and adverse effects:	
A. Real income distribution	1. Create 5 low to medium income jobs with semi-skilled requirements for local residents.
	2. Increase the number of farms with gross sales of $5,000 or more from 64 to 110.
	3. Improve employment opportunities for about 50 local agricultural workers.
B. Life, health,and safety	1. Provide 100-year frequency level of flood protection to existing road system and to buildings now located in the flood plain.
	2. Provide for development of public water system to serve about half of the present residents of Brunswick County by 1980.
	3. Homes with complete kitchen plumbing are expected to increase from 62 percent (1970) to 80 percent and those with flush toilets from 56 percent to 75 percent by 1985.
C. Recreational opportunities	1. Create opportunity for an estimated 12,000 recreation visits annually for fishing in the reservoir.

Selected Plan
Great Creek Watershed Project, Brunswick & Lunenburg Counties, Virginia
ENVIRONMENTAL QUALITY ACCOUNT

Components	Measures of effects
Beneficial and adverse effects:	
A. Areas of natural beauty	1. Create a lake of 212 acres in an area with few open water vistas.
	2. Inundate 4.8 miles of stream.
	3. Inundate or occupy with structure 32 acres of cropland, 4 acres of pastureland, 183 acres in forest land, and 17 acres in other uses.
	4. Intermittent interruption of use of 7 acres of cropland and 399 acres in forest and other uses.
B. Quality considerations of water, land, and air resources	1. Reduce erosion on 8,438 acres of cropland, pastureland, forest land, and other land.
	2. Reduce sediment leaving the watershed by 15,433 tons annually.
	3. Provide storage for high quality public water supply.
	4. Increase air pollution from increased vehicular traffic.
	5. Reduce sediment damages downstream in the Meherrin and Chowan Rivers.
	6. Reduce gross erosion rates from an average of 4.2 to 3.4 tons per acre per year.

Selected Plan
Great Creek Watershed Project, Brunswick & Lunenburg Counties, Virginia
ENVIRONMENTAL QUALITY ACCOUNT

Components	Measures of effects
C. Biological resources and selected ecosystems.	1. Enlarge by 212 acres habitat for fish and waterfowl.
	2. Provide resting area at reservoir for migratory waterfowl.
	3. Inundate 4.8 miles of stream having approximately 5 sucker type fish of usable size per mile.
	4. Improved wildlife habitat from wildlife habitat management practices on lands with a conservation plan.
	5. A decrease of 212 acres of terrestrial wildlife habitat (approximately 2.0 percent of the watershed area)
D. Irreversible or Irretrievable Commitments	1. Commitment of 642 acres presently in cropland, pastureland, forest land, and idle and other uses to structure, reservoir and flood pool, open and green spaces.

PART II

FINAL

ENVIRONMENTAL IMPACT STATEMENT

GREAT CREEK WATERSHED

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

USDA-SCS-EIS-WS-(ADM)-76-2(F) VA

GREAT CREEK WATERSHED PROJECT

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

FINAL ENVIRONMENTAL IMPACT STATEMENT

D. N. Grimwood, State Conservationist
Soil Conservation Service

SPONSORING LOCAL ORGANIZATIONS

Southside Soil and Water Conservation District
William F. Vaughan, Chairman
Route 1, Keysville, Virginia 23947

Brunswick County Board of Supervisors
Sidney J. Brandon, Sr.,Chairman
Route 4, Blackstone, Virginia 23824

Town of Lawrenceville, Virginia
E. N. Doyle, Jr., Mayor
Lawrenceville, Virginia 23868

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Richmond, Virginia 23240

April 1976

USDA FINAL ENVIRONMENTAL IMPACT STATEMENT
GREAT CREEK WATERSHED PROJECT
BRUNSWICK AND LUNENBURG COUNTIES
VIRGINIA

Prepared in Accordance with
Sec. 102(2)(C) of P.L. 91-190

SUMMARY

I. Final

II. Soil Conservation Service

III. Administrative

IV. Description of Project Purpose and Action:

A project for watershed protection, flood prevention, municipal and industrial water storage in Brunswick and Lunenburg Counties, Virginia, to be implemented under authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress, 68 Stat. 666), as amended.

A 57-foot high earth fill dam will be built to store water, trap sediment, and reduce flooding downstream. Approximately 8,438 acres of watershed will be treated by the application of conservation land treatment measures under the accelerated as well as the going program. Both vegetative and structural types of land treatment measures will be used to reduce runoff, conserve soil moisture, and prevent excessive loss of topsoil on 175 farms.

V. Summary of Environmental Impacts Including Favorable and Adverse Environmental Effects:

Floodwater and sediment damages will be reduced by approximately 71 percent, allowing for more efficient and effective use of about 300 acres of flood plain. This will increase farm income. The amount of sediment leaving the watershed will be reduced by approximately 15,433 tons annually. Sediment damages to the Emporia reservoir and the Meherrin River will decrease. Land treatment measures on 8,438 acres of watershed land will reduce the gross erosion rate from 4.2 to 3.4 tons per acre per year, retarding runoff, improving wildlife habitat, and enhancing the esthetic values of the watershed. The project will create 212

acres of warm water fishing and waterfowl habitat. Planned land treatment measures include 15 acres of wildlife habitat management for specific sites. Wildlife habitat management practices are included in recommendations for all land uses. The impoundment will decrease terrestrial wildlife habitat by 212 acres and will inundate 4.8 miles of perennial stream and 2.1 miles of intermittent stream.

Facilities will be provided for an estimated 12,000 annual recreation visits. This project will inundate 212 acres and restrict the land use of approximately 430 acres presently in forest land, cropland, and pastureland.

The project will provide a high-quality water source for expansion of a public water system and create approximately 40 man-years of employment during installation and 5 permanent jobs. Living conditions in the area will be improved by controlling floodwaters. Construction will temporarily increase turbidity in the area and downstream.

After the project is complete, activity in the area will increase. Vehicular traffic, noise, fire hazard, solid waste, and litter will also increase as a consequence of the influx of people in search of recreation activities, mainly fishing.

During severe drought periods there could be a maximum of 76 acres of exposed area due to drawdown of the municipal water pool. Water storage allowance will be provided for flow management.

VI. List of Alternatives:

1. Accelerated Land Treatment Only

2. Land treatment with Acquisition of Flood Plain Land and Flood Plain Properties.

3. Land Treatment and Channel Work

4. Land Treatment and Diking

5. Land Treatment and Single-Purpose Water Supply Structure

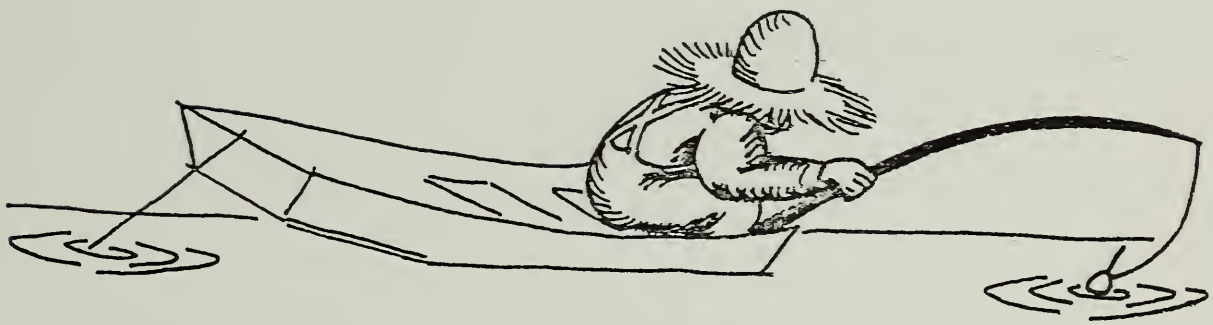
6. Land Treatment and the Meherrin River as the Water Source

7. No Project

VII. Agencies from which written comments have been received:

Department of the Army
Department of the Interior
Department of Transportation
Environmental Protection Agency
Council on the Environment, Commonwealth of Virginia
Virginia Soil and Water Conservation Commission

VIII. Draft Statement transmitted to Council on Environmental Quality on October 10, 1975.



USDA SOIL CONSERVATION SERVICE
FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR

GREAT CREEK WATERSHED
BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83d Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

Southside Soil and Water Conservation District
Brunswick County Board of Supervisors
Town of Lawrenceville

PROJECT PURPOSES AND GOALS 1/

Overall goals that the sponsors established for the project at the time of application and as modified in the early stages of planning are: (1) to prevent erosion, to maintain the soil for sustained use; (2) to provide water storage, to elevate family standards of living; (3) to improve and protect the environment, to provide attractive, convenient, and satisfying places to live, work, and have recreation; and (4) to provide for improved use of flood plain lands for agricultural purposes. The planned project does not and cannot provide for all of these stated goals. The project sponsors, the public, and the Soil Conservation Service came to agreement on purposes for the proposed watershed plan which would help obtain the watershed goals. These purposes are: (1) watershed protection; (2) flood prevention; and (3) municipal and industrial water supply.

The purpose of watershed protection will be achieved through the installation of land treatment measures on a minimum of 70 percent of the land by the end of the project installation period. Among the sources of erosion are unvegetated road cuts and fills, lack of conservation practices on cropland, overgrazed pastureland, and poor practices involved in harvesting forest products.

Technical assistance for soil surveys and other resource inventories and evaluations, for development of land use, conservation and woodland management plans and for assistance in installation of key conservation practices are important considerations in achieving desired levels of watershed protection. Measures included in plans must recognize the present condition and needs of the land and its committed use. Cropland, pastureland, and forest land are not adequately protected and are a vital concern. Maintenance of adequate protection of other land is also important. Control of erosion and sediment at or near its source is the principal goal of watershed protection and normally a function of the land treatment phase of a plan. It is desired to reduce the sediment originating in the watershed by about 75 percent and to reduce average gross erosion rates from 4.2 to 3.4 tons per acre per year.

Protection of agricultural lands, bridges, and highways from flooding are a concern. Goals were set up to carry out the purpose of flood prevention. The goals are to protect a minimum of 50 percent of the flood plain in the benefited area of the watershed from at least a 2-year frequency flood and to protect all existing highways in the project area from significant damage from the 100-year frequency storm.

1/ All information and data, except as otherwise noted, were collected during the watershed planning investigation conducted by the Soil Conservation Service and Forest Service, of the U.S. Department of Agriculture.

The need for additional sources of water is a vital concern especially as it is a necessity for sustaining life and also a necessity for continuing the economic growth in the area. Present needs are being taken care of but based on industrial needs and population projections, problems of supplying water will exist in the future. Therefore, goals were set to provide water storage for the county in the structure to help meet future water requirements.

Although no project purpose was set up for fish and wildlife and recreation, agreement was made to set a goal of providing fishing and other incidental recreation. This would include public access roads, parking, sanitary facilities, and recreational developments compatible with public water supply. Also existing fish and wildlife resources of the watershed would be preserved by incorporation of wildlife habitat improvements in planned land treatment measures.

PLANNED PROJECT

The Southside Soil and Water Conservation District, the town of Lawrenceville, and the Brunswick County Board of Supervisors, sponsoring local organization, will be responsible for the successful application of this project. Their responsibilities will be supplemented by memoranda of understanding, and cooperative agreements with other agencies, individuals and organizations.

An installation period of 5 years has been established for the measures proposed. Land treatment measures will be installed more or less uniformly over the entire project installation period. It is anticipated that the structure design will be prepared in the first year, construction contracts awarded during the second year, with construction substantially completed by the end of the third year, leaving only minor items, project administration activities and technical assistance for land treatment measures for the fourth and fifth years.

LAND TREATMENT MEASURES

The Southside Soil and Water Conservation District will coordinate the installation of the proposed land treatment measures. Landowners and operators will be encouraged to apply and maintain the needed measures and treatment for their land. The Soil Conservation Service will complete soil surveys of 19,310 acres and provide technical assistance to landowners and operators in the planning and application of needed measures and land use changes. The Virginia Division of Forestry, in cooperation with the U.S. Forest Service, will provide technical assistance with the application of forestry measures. At least 50 percent of the farmland above the structure will be under cooperative agreement with the District before construction is initiated.

The procedure followed for developing plans with land uses for conservation treatment of their lands is as follows:

1. Determine needs and objectives

2. Provide soil and water inventory data. Usually includes land use, soil survey, water management and vegetative information.

3. Interpret, analyze and evaluate soil and water inventory data.

4. Develop and evaluate conservation land treatment alternatives.

5. Land user makes decision and selects desired alternatives.

6. Decisions are recorded and become land users conservation plan. The plan reflects conservation action to be taken to achieve conservation land treatment on his land.

A completed conservation land treatment plan will reduce soil losses to acceptable levels.

Since cropland is most vulnerable to erosion and other hazards, land with the best production potential and least hazard potential is recommended for crops. Land with high erosion and other hazards is recommended for protection by perennial vegetative cover such as pasture grasses, trees, or food and cover for wildlife.

Table 1A lists land treatment measures applied prior to development of this plan. Additional treatment needs are discussed below for each type of land use. Acreage requiring treatment has been determined and listed based on existing land use (See table on Land Capability Classes and Present Land Use). Any change in land use could cause figures on treatment needs to vary accordingly.

Cropland - Two thousand acres of cropland are considered to be adequately treated and cropped under an acceptable conservation cropping system (Table 1A). This leaves 1,662 acres that still require varying degrees of conservation treatment. These areas are the major sources of sediment and, consequently, are a potential source of pesticide and fertilizer pollutants associated with soil erosion. Eight hundred acres will receive accelerated land treatment during the project period.

Measures needed to achieve adequate treatment of cropland include contour farming, conservation cropping system, and diversions; grassed waterways to carry water safely down the slope without developing gullies; drainage to remove the excess water that limits operational and productive efficiency on crop fields; cover and green manure crops to minimize erosion on fields during the winter; and improve the organic matter content of the soil; using minimum tillage; and using crop residue management to improve tilth and increase waterholding capacity, thereby decreasing erosion and runoff. All of these measures are planned to keep as much protective cover on the soil as much of the time as possible. Many alternative combinations of Resource Management Systems which include these practices can be used satisfactorily by the individual landowner. The selection of measures to be installed is based on the needs for land treatment of the specific soils as they are used in individual Resource Management systems.

Pastureland - Of the 2,949 acres in the watershed used for permanent pasture and hay, 1,600 acres are adequately treated and do not require additional inputs to achieve minimum levels of treatment. (Table 1A). The remaining 1,349 acres require appropriate combinations of pasture management, brush management, pasture planting, and perhaps planned grazing systems to keep an adequate conserving cover on the soil. Adequate cover holds the soil in place, reduces soil compaction from raindrop impact, and increases the infiltration rate of water into the soil. Six hundred and twenty-five acres will receive accelerated land treatment.

Proper pasture and hayland management also increases the productive capacity of pasture or hayland; increased forage is available for harvest and for production of livestock and related products.

Forest Land - Treatment with varying degrees of intensity is planned on 6,980 acres. Fire prevention and insect and disease control are planned for the total acreage. The following remedial program has been developed from a statement of land treatment needs prepared by the Virginia Division of Forestry in cooperation with the U.S. Forest Service. The land treatment needs were determined from a field survey of the watershed.

Tree Planting - Tree planting for reforestation of appropriate open land and cutover forest land is necessary to adjust land use to capability and to rehabilitate existing forest land to reduce runoff and erosion by developing a protective cover and an absorbent forest floor of litter and humus. Hydrologic cultural operations are aimed at improving hydrologic conditions by manipulating stand composition to create favorable conditions for the maximum production and protection of litter, humus, and forest cover. They include supplemental plantings, weedings, thinnings, timber stand improvement, release and harvest cuttings. Forest land grazing control by fencing-out domestic livestock prevents impairment of hydrologic conditions in forest land by reducing soil compaction, damage to tree roots, seedlings, and other ground cover, and the loss of litter and humus. Skid-trail and logging-road erosion control will reduce runoff, erosion, and sedimentation by diverting water from eroding skid trails and logging roads. Simple water bars (ditches with pole and earthen diversions) spaced at specified intervals are the usual means used to divert this type of surface runoff.

Other Land Uses - This category includes 33 acres which need land treatment, 15 acres of wildlife habitat improvement on specific sites, and 5 acres of recreation area improvement. Wildlife habitat management practices are included in recommendations for all land uses. The actual application of the above measures will be made by the individual owners or operators controlling the land where treatment is needed. Application of these measures will have secondary benefits such as improvement of the visual quality of the landscape and general enhancement of the environment.

Achieving Needed Land Treatment - The process of achieving the needed land treatment will involve several steps. A detailed inventory of needed conservation measures will be made on the areas not adequately treated. This study will be made by individual landowners with assistance from the Soil Conservation Service or Virginia Division of Forestry. It will identify the specific needs. Conservation plans for the needed land treatment will be developed as described under land treatment measures.

To provide for the proper installation and maintenance of needed measures, individual forest management plans involving 3,000 acres will be prepared for approximately 70 landowners. These plans outline practical measures to be applied in the immediate future to maintain and improve the hydrologic condition of their forest land. These plans will be incorporated in the total conservation plan for landowners in the watershed. Technical assistance is also needed for the stimulation of landowner interest and participation in the watershed program and general planning, supervision, and inspection in the forestry program.

A basic component needed for the land-treatment-needs inventory is a soil survey to determine the kinds of soil and their physical and chemical characteristics. This survey is used as a basis for developing conservation land treatment alternatives for land users. Soil surveys of 19,310 acres are needed in the watershed.

Planning and application of measures will be in cooperation with the Southside Soil and Water Conservation District. Technical assistance for planning the use of all land and installation of conservation measures on nonforest land will be provided by the Soil Conservation Service. The Virginia Division of Forestry, in cooperation with the U.S. Forest Service, will provide technical assistance for installing conservation measures on forest land and for providing forest fire and insect and disease protection. The forester assigned to this project will provide accelerated technical assistance to landowners and operators to solve any forestry-related problems. The forester will prepare forest land management plans to be included as a part of the conservation farm plans.

STRUCTURAL MEASURES

One multiple-purpose structure is proposed on the main stem of Great Creek, about 4 miles upstream from U.S. Highway No. 58, as shown on the project map. The structure will have a principal spillway system consisting of a drop inlet riser, a monolithic concrete conduit 5.9 feet x 4.4 feet (HxW), and a SAF stilling basin. The plan is based on the principal spillway resting on a yielding foundation. The excavated conduit trench will be backfilled with suitable borrow material. The emergency spillway system, designed to pass flows in excess of the floodwater detention storage and controlled release, will consist of a concrete chute with a box inlet 61 feet by 185 feet (BxW), and a 475-foot wide vegetated spillway.

The structure has a design life of 100 years, and will pass the 100-year frequency runoff through the principal spillway without emergency spillway flow. It will control the runoff from 26,074 acres (40.74 square miles), or 87.6 percent of the total watershed area. The floodwater detention capacity is equivalent to 4.60 inches of runoff from the controlled area, or 4.03 inches from the entire watershed. Storage capacity will be provided for the 100-year sedi-

ment volume, about 94 percent of which will initially store water. Total storage capacity of the structure is 11,866 acre-feet including 10,000 acre-feet of flood storage, 916 acre-feet of sediment storage, and 950 acre-feet of water supply storage. The total storage was increased from 8,585 acre-feet to 11,866 acre-feet because of structural site conditions.

The dam will be about 57 feet high and will be constructed of approximately 221,400 cubic yards of compacted earth fill including backfill for the cutoff and conduit trenches. All of the borrow material will be obtained from the emergency spillway excavation on the left abutment; most of this material is SM, with lesser amounts of ML and MH. Constructed side slopes for both the dam and emergency spillway will be three to one. The reservoir area will be cleared to an elevation one foot above the maximum surface level of the water supply pool.

The watershed is in Seismic Risk Zone 2 1/ corresponding to damage intensity VII of the Modified-Mercalli Scale. A search of literature 2/ discloses that the last earthquake felt in Brunswick County was in 1969 with an intensity of IV. The area has felt many earthquakes; the last major one was in 1897. Building damage varies according to its construction. A major earthquake is defined as one with an intensity greater than VIII on the Mercalli scale.

The final design of each proposed earth dam and appurtenances will include earthquake hazard evaluations of any critical conditions found during the detailed site investigations.

Soil Conservation Service standards and specifications will be used as a guide in preparing the construction contract for this project. Quality control will be based upon industry standards such as those of the American Society for Testing Materials, American Institute of Steel Construction, American Concrete Institute, American Water Works Association, and Federal Specifications and Standards. Soil Conservation Service structure classifications are determined by the damage that might occur to existing and future

1/ Algermissen, S. T., Seismic Risk Map of United States, 1969.

2/ Hopper, M. G., and Bollinger, G. A., The Earthquake History of Virginia, Department of Geological Sciences, Virginia Polytechnic Institute and State University, 1971, 1972.

developments downstream resulting from a sudden breach of the earth embankment and to the structures themselves. Design criteria for a given structure is then based on the selected classification. The principal spillway is sized to empty the flood storage in ten days or less.

All construction activities will be performed under intensive inspection by qualified personnel. After completion of the project, inspections will be made annually, after severe floods, and after the occurrence of any other unusual conditions to determine safety hazards, and operation and maintenance needs.

The appurtenant features for water supply consist of three 12-inch slide gates installed in the riser, and a ladder to gain access thereto. The three gates will be located at different elevations, the lower one being at the sediment pool elevation. The water will be discharged to the stream and picked up at the treatment plant approximately 2.7 miles downstream. Nonproject features consist of a pumping station for the raw water intake, a water treatment plant, and a water distribution system.

During construction, appropriate measures will be taken to minimize soil erosion as well as water, air, and noise pollution. These measures will be determined on the site by evaluating the pollution hazard in relation to established standards for the area in question. The plans and specifications for the structure will include erosion control measures such as sediment and debris basins, diversions, temporary stream crossings, dust suppressors, temporary vegetation, etc. Turbidity is expected to increase temporarily during construction. The average annual sediment concentration at the proposed damsite under present conditions is estimated to be 601 m/l. The expected concentration during construction is 655 mg/l. The rate is then expected to drop to 46 mg/l after construction is completed and land treatment measures are installed. The sequence of operations will also be specified in order to minimize the pollution hazard. After construction is completed, an adequate grass cover will be established on all disturbed areas within one growing season.

The contractor will be required to keep the project site and access roads in an orderly condition. Upon completion of the work, he will be required to remove all buildings, debris, unused material, forms, etc. from the areas specified. All debris removed from either the cleared or the cleared-and-grubbed areas will be disposed of in an acceptable manner. Any solid or liquid wastes which might cause pollution will be handled in accordance with applicable state and local laws. Vector control, where necessary, will be accomplished through the use of local drainage and approved insecticides. The contractor will also be required to comply with the provisions of the Construction Safety Act of 1969 (P.L. 91-54).

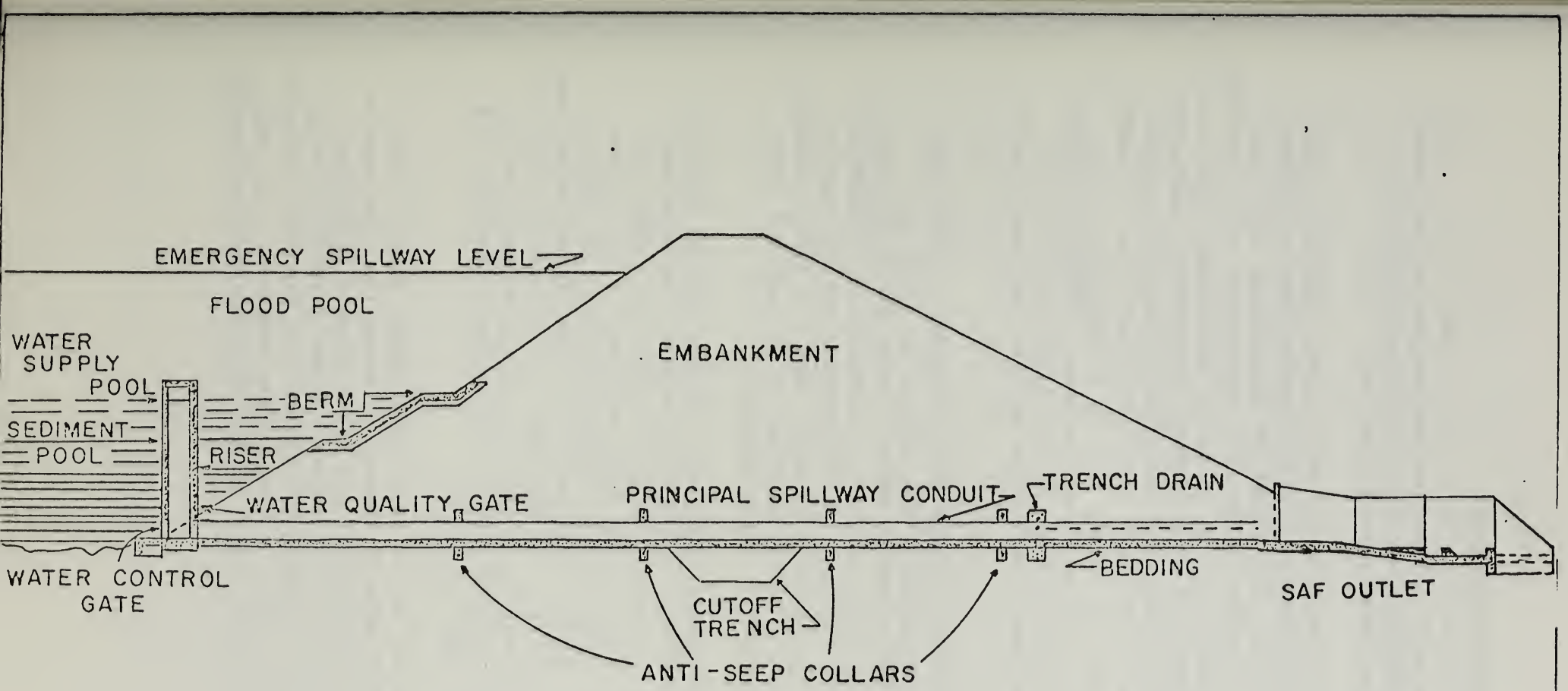
Installation of the dam will require the purchase of, or flowage easements on, a minimum of 719 acres. Current land use in the area to be inundated by the sediment and water supply pool is 32 acres of cropland, 163 acres of forest, and 17 acres of other uses. Land use in the flood detention pool area, between the water supply pool and the emergency spillway crest, is currently 7 acres of cropland, 365 acres of forest, and 34 acres of other uses. Current land use in the construction area is 4 acres of pastureland and 20 acres of forest land. The remaining 77 acres requiring flowage easements are between the emergency spillway crest and design high water elevations. This impoundment will decrease terrestrial wildlife habitat by 212 acres and will inundate 4.8 miles of perennial stream and 2.1 miles of intermittent stream.

Investigation by the sponsors has disclosed that, under present conditions, installation of the dam will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, Brunswick County will provide relocation assistance advisory services and relocation assistance. Relocation payments will be cost-shared in accordance with the percentages shown in the Watershed Plan Agreement. One secondary state highway (No. 763) will be slightly affected by installation of the dam. The road will be flooded only by storms in excess of the 100-year, 24-hour duration; however, about 400 feet of the road would be flooded to a maximum depth of about 8 feet at the crest elevation of the emergency spillway. Section 33.1-223.2 of the Code of Virginia grants the State Department of Highways and Transportation authority to permit temporary closing roads. Permission will be obtained from the Department of Highways and Transportation to close it temporarily during flooding. Brunswick County will be responsible for the posting of warning signs and for closing off the road during extremely high flood flows. A stream gage at the same crossing will require relocation.

Brunswick County, separate and apart from this plan, in cooperation with the Virginia Commission of Game and Inland Fisheries, will stock the impoundment with fish and provide for public access to the site. This will provide 212 surface-acres at full pool, which the county plans to open for bank and boat fishing. The sponsors will at their expense, purchase a minimum of 5 acres on the east bank and a fifty foot strip around the permanent pool which will be set aside for recreational development. Facilities to provide for public use will include access road, boat ramp, parking areas for cars and boat trailers, and modern sanitary facilities as required by state and local health laws, adequate for full use of the lake (12,000 visits per year). All facilities will be designed for use by the handicapped, and for the safety of all users. The cost of these measures and their operation and maintenance will be defrayed by a user fee, not to exceed the rate required for return of investment plus operation and maintenance costs.

A 12-inch slide gate will be installed 5 feet above the base of the riser. This gate, which is designed for flow management, will provide a means for releasing water from the lower part of the reservoir during wet periods. The water supply gates will serve the function of releasing water during drought periods in order to maintain a minimum downstream rate equal to the 10-year, 7-day low flow. Provision has been made in the storage capacity for this purpose. The purpose of this downstream release is to offset the effects of diverting water for municipal and industrial uses. Virginia state law further requires that the flow below an impoundment be at least equal to the flow immediately above the structure when that flow is equal to or less than the average flow. This gate will provide the necessary means to accomplish this purpose. The gate will be operated and maintained by Brunswick County.

According to the Virginia Historic Landmarks Commission and the Virginia State Archeologist there are no known sites of historical or archeological importance that would be affected by the installation of this project. The National Park Service and the Virginia State Archeologist will be notified before construction begins, and also in the event any significant discovery is made during construction. The project will be delayed or halted, should anything be found either before or during construction, until appropriate actions satisfactory to the sponsors, the Service, and other concerned authorities are taken.



SECTION OF A TYPICAL WATER SUPPLY AND FLOODWATER RETARDING STRUCTURE

Fig. 1

OPERATION AND MAINTENANCE

Land treatment measures will be operated and maintained by landowners and operators through cooperative agreements with the Southside Soil and Water Conservation District.

Brunswick County will be responsible for operation and maintenance of the multiple-purpose structure at an estimated cost of $2,000 annually. Brunswick County will stock the impoundment with fish and will provide public access to the site. Resources and facilities provided for public fishing will be operated, maintained, and replaced as necessary. The county will also operate and maintain sanitary facilities as required by state and local health laws and regulations to allow full use of the lake for fishing and other incidental recreation. In addition, the county will be responsible for the repair and replacement of recreational equipment and facilities. Funds for operation and maintenance of the fishery resources and facilities provided for public recreation will be obtained from user fees.

Typical operation items will include the operation of gates for water supply and flow management, the removal of trash and debris from the pools and structure after floods, the development and enforcement of regulations for use of recreational facilities, the restriction of motor vehicles to designated roads and parking areas, the prevention of pollution to water used for public consumption and/or recreation, the timely disposal of garbage and other refuse, and the elimination of safety hazards.

Typical vegetative maintenance items will include mowing, fertilizing, reseeding, weed control, and grazing control for vegetated areas. Maintenance of the earth dam may include replacement and revegetation of eroded areas in the earth spillway or on the dam itself, inspection and clean-out of drainage systems, and replacement of rock riprap as needed. Maintenance of appurtenant structures may include removal of debris from the trash racks and SAF outlet, maintenance of gates and valves, repainting of all surfaces requiring protection by paint, maintenance of recreational features, and repairing or replacing signs as needed.

Designated representatives of the Soil Conservation Service and the sponsors will jointly make an inspection annually, after severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structure. These inspections will continue for three years following installation of the dam. Inspections after the third year will be made by the sponsors. They will prepare a report, and furnish a copy to the Soil Conservation Service

employee responsible for the inspection follow-up activities. These reports will be thoroughly reviewed by the Soil Conservation Service representative. Any evidence of needed inspections, or maintenance not being performed properly, will be reported immediately and appropriate action taken by the responsible sponsor.

Specific operation and maintenance agreements will be executed prior to signing a landrights, relocation, or project agreement. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with P.L. 566 financial assistance. The operation and maintenance agreements will contain a reference to the Virginia Operation and Maintenance Handbook and an operation and maintenance plan will be prepared.

PROJECT COSTS

Total project installation cost is estimated to be $1,639,600. Public Law 566 funds will provide $1,279,450 and others will provide $360,150 of this amount. The multiple-purpose dam is estimated to cost $1,417,470; with Public Law 566 funds bearing $1,186,650,and others $230,820 of these costs. The benefit-cost ratio is 1.4 to 1.0. Appendix A of this statement summarizes the average annual benefits, costs, and benefit-cost ratio.

ENVIRONMENTAL SETTING

PHYSICAL RESOURCES

The 46.49 square miles (29,754 acres) that drain into Great Creek in this watershed project include that portion of the Great Creek drainage from the headwaters in east-central Lunenburg County to the confluence with Roses Creek southeast of Lawrenceville in central Brunswick County, Virginia. Great Creek flows generally southeasterly into the Meherrin River, a tributary of the Chowan River. As delineated by the Water Resources Council 1/, Great Creek is in the Roanoke subregion (0301) of the South Atlantic Gulf Region (03) which eventually discharges into the Atlantic Ocean. It is in Land Resource Area 136, the Southern Piedmont area of the South Atlantic and Gulf Slope Cash Crop, Forest, and Livestock Region 2/. The watershed is generally typical of this area of the Piedmont Region, with a predominantly rural setting.

Both Brunswick and Lunenburg Counties were classified as rural by the 1970 U.S. Census, since neither county has an incorporated town with a population of 2,500 people. Lawrenceville, the county seat of Brunswick County, is the only incorporated town in the watershed and had a 1970 population of 1,636 3/. The other incorporated towns in Brunswick County are Alberta and Brodnax, each with a 1970 population of less than 500. There are two incorporated towns in Lunenburg County, Kenbridge and Victoria, which had 1970 populations of 1,223 and 1,408, respectively 3/. Emporia, Virginia, about 20 miles to the east, is the nearest urban center. It had a population of more than 5,000 in 1970. Richmond, the State capital, about 65 miles northeast, is considered the hub of economic activity for this region, delineated as Region 021 by the Bureau of Economic Analysis, Social and Statistics Administration. Other metropolitan centers within 200 miles include Petersburg, Colonial Heights, Roanoke, Danville, and Norfolk, Virginia; Raleigh, Durham, and Greensboro, North Carolina; Washington, D.C.; and Baltimore, Maryland.

There are 1,517 acres of flood plain land in the watershed, of which 68 acres are in cropland, 28 acres in pastureland, 1,393 acres in forest land (of which 170 acres are in and adjacent to Lawrenceville), and 28 acres are in other uses such as highways, public utilities, etc.

1/ 1972 OBERS Projections, Regional Economic Activity in the U.S.; Volume 3, September 1972, U.S. Water Resource Council, Washington, D.C.

2/ Austin, Morris E., Land Resource Regions and Major Land Resource Areas of the United States, Soil Conservation Service, U.S. Department of Agriculture, Agriculture Handbook 296,1965.

3/ U.S. Bureau of the Census, Washington, D.C., Census of Population, 1970.

A field investigation of the forest land on the flood plain revealed plants such as river birch, winged elm, common alder, green ash, hawthorn, box elder, hackberry, ironwood, and black willow, which are of low economic and market value. Where they are not subject to flooding, the flood plain soils respond well to improved management practices and are easily developed for a wide variety of uses. Thirty-six and one-half acres have overwash resulting in erosion and sediment.

Soils - Three of the four major upland soil associations of this watershed were formed from material weathered from acid rocks such as granite, gneiss, and schists. Refer to Soil Associations Map of Great Creek Watershed.

The Appling-Durham association occupies about half of the area, beginning in the headwaters and extending downstream below U.S. Highway 1. These soils are well drained, with moderate internal drainage and permeability. They respond well to modern fertilization and management practices for agriculture and produce good yields of tobacco, corn, soybeans, small grain, hay, and pasture.

The Cecil-Appling-Madison association occupies most of the eastern side of the lower half of the watershed; and the Appling-Cecil gravelly fine sandy loam association occupies the western side. These soil associations are well drained, with moderate internal drainage and permeability. These soils are highly responsive to fertilization and other modern management practices for agriculture, and produce good yields of corn, hay, small grain, and pasture.

There is a small area of the Georgeville-Herndon soil association in the downstream end of the watershed below U.S. Highway 58. These soils are similar to the Cecil-Appling association in color, structure, and horizon relationship. They were derived from finer-grained parent material, and usually contain larger quantities of silt. The cleared areas are used primarily for corn, small grain, hay, and pasture and respond well to modern management practices.

There are two major flood plain soil associations in this watershed.

The Wehadkee-Chewacla association occupies the upper three-fourths of the flood plain. The downstream fourth of the flood plain is primarily the Toccoa-Wehadkee-Chewacla association with small areas of Congaree soils. Both of these soil associations are composed of mixed alluvial sediments washed from the surrounding uplands. Drainage is quite variable. A high percentage of these soils respond well to modern management methods for agricultural production and are some of the most productive soils in the watershed if properly managed.

SOIL ASSOCIATIONS ON GREAT CREEK WATERSHED

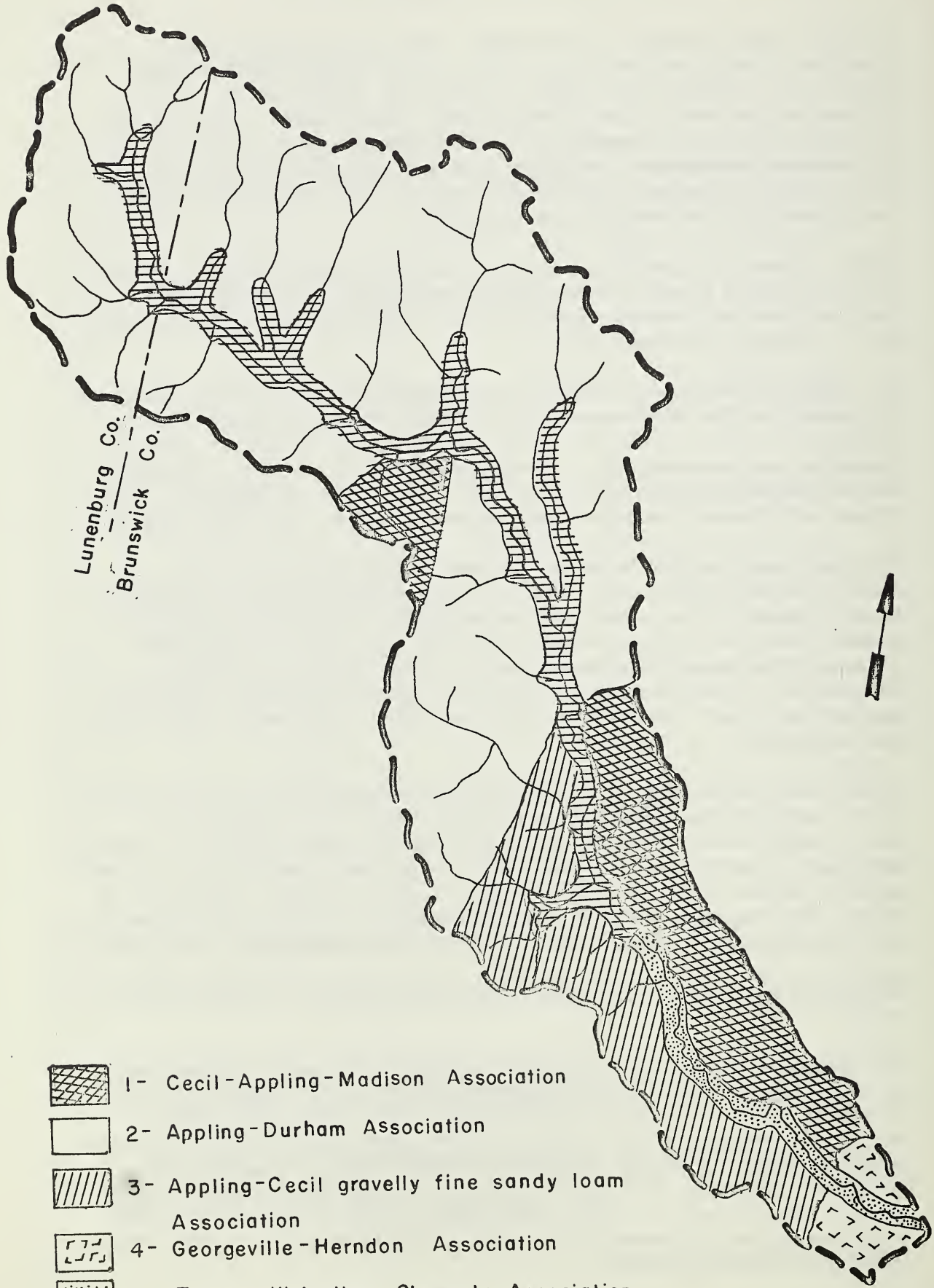


Fig. 2

Even though the soils on the flood plain represent a relatively small portion of the total acreage, they are highly important. The botton lands have been in productive agricultural use for over 200 years and were used very intensively for intertilled crops until about 1935. Through the 1920's, agricultural production expanded into the uplands without conservation measures and conditions arose where these upland soils became more susceptible to erosion and provided a fresh and abundant supply of sediment. When this sediment filled the creek, it no longer could carry normal runoff within its banks and more flooding occurred. Since the 1940's there has been a general shift to forest land in the flood plain, with the cultivated crops being moved to the upland areas, due primarily to the flood hazard.

Land capability classification is a system for grouping soils that show suitability for farming; it is a practical classification based on use limitations, risk of damage from use, and the way soils respond to treatment.

The Soil Conservation Service of the U.S. Department of Agriculture has defined eight land capability classes which are designated by Roman numerals I through VIII. The hazards and limitatations of use increase as the Roman numerals increase.

In this watershed, some of the class II soils would be class I if it were not for the hazard of flooding. The class III land is found along flood plain edges and upland terraces; the main uses are cropland, pastureland, and forest land. The class IV soils are on moderate slopes in the watershed and are used mainly as forest land.

Class VI soils are found on steeper slopes in the watershed and are not well adapted to cultivated crops due to erosion. Class VII soils are found on the steeper slopes in the watershed and are best suited for use as forest land. Due to the flood hazard and ownership patterns, cultivated crops are grown on both Class VI and VII land. These cropland areas require unusually intensive land management practices for erosion control to prevent gully formation. These practices increase farm operating costs, lowering farm income. The Great Creek watershed is composed of the following land classes:

LAND CAPABILITY CLASSES AND PRESENT LAND USE

Land Capability Class	Percent of Total in each class	Acres in Each Use: Cropland	Pasture-land	Forest Land	Other	Total Acres
I	.2	73	0	0	0	73
II	37.5	2087	1386	7529	151	11,153
III	22.6	806	560	5248	118	6,732
IV	20.06	366	325	5247	30	5,968
V	3.14	73	177	684	0	934
VI	14.0	110	177	3879	0	4,166
VII	2.5	147	324	228	29	728
VIII	0.0	0	0	0	0	0
Total Acres		3662	2949	22,815	328	29,754
Percent of Total in Each Land Use		12	10	77	1	100

Class I - Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. The soils are nearly level 1/ and erosion hazard (wind or water) is low. They are deep, generally well-drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

Class II - Soils in this class require careful soil management, includind conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

Class III - Soils in class III have more restrictions than those in class II and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

1/ *Some rapidly permeable soils in Class I may have gentle slopes.*

Limitations of soils in class III restirct the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or a combination of these items. The limitations may result from the effects of one or more of the following: (1) moderately steep slopes, (2) high susceptibility to water or wind erosion or severe adverse effects of past erosion, (3) frequent overflow accompanied by some crop damage, (4) very slow permeability of the subsoil, (5) wetness or some continuing waterlogging after drainage, (6) shallow depths to bedrock, hardpan, fragipan, or claypan that limits the rooting zone and the water storage, (7) low moisture-holding capacity, (8) low fertility not easily corrected, (9) moderate salinity or alkali, or (10) moderate climatic limitations.

Class IV - Soils in class IV may be well suited to only two or three of the common crops or the amount of harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as (1) steep slopes, (2) severe susceptibility to water or wind erosion, (3) severe effects of past erosion, (4) shallow soils, (5) low moisture-holding capacity, (6) frequent overflows accompanied by severe crop damage, (7) excessive wetness with continuing hazard of waterlogging after drainage, (8) severe salinity or alkali, or (9) moderately adverse climate.

Many sloping soils in class IV in humid regions are suited for occasional but not regular cultivation. Some of the poorly drained, nearly level soils placed in class IV are not subject to erosion but are poorly suited to intertilled crops because of the time required for the soil to dry out in the spring and because of low productivity for cultivated crops. Some soils in class IV are well suited to one or more of the special crops, such as fruits and ornamental trees and shrubs, but this suitability itself is not sufficient to place a soil in class IV.

Land Limited in Use - Generally Not Suited for Cultivation Class V - Soils in this class have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations. Examples of class V are (1) soils of the bottom lands subject to frequent overflow that prevents the normal production of cultivated crops, (2) nearly level soils with a growing season that prevents the normal production of cultivated crops, (3) level or nearly level stony or rocky soils, and (4) ponded areas where drainage for cultivated crops is not feasible but where soils are suitable for grasses or trees. Because of these limitations cultivation of the common crops is not feasible but pastures can be improved and benefits from proper management can be expected.

Class VI - Physical conditions of soils placed in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing and water control with contour furrows, drainage, ditches, diversions, or water spreaders. Soils in class VI have continuing limitations that cannot be corrected, such

as (1) steep slope, (2) severe erosion hazard, (3) effects of past erosion, (4) stoniness, (5) shallow rooting zone, (6) excessive wetness or overflow, (7) low-moisture capacity, (8) salinity or alkali, or (9) severe climate. Due to one or more of these limitations these soils are not generally suited for cultivated crops. But they may be used for pasture, range, woodland, or wildlife cover or some combination of these.

Some soils in class VI can be safely used for the common crops providing unusually intensive management is used. Some of the soils in this class are also adapted to special crops such as sodded orchards, blueberries, etc., requiring soil conditions unlike those demanded by the common crops. Depending upon soil features and local climate the soils may be well or poorly suited to woodlands.

Class VII - Physical conditions of soils in class VII are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water-control measures such as contour furrows, ditches, deversions, or water spreaders. Soil restrictions are more severe than those in class VI because of one or more continuing limitations that cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soil, salts or alkali, unfavorable climate, or other limitations that make them unsuited for common cultivated crops. They can be used safely for grazing or woodland or wildlife food and cover, or some combination of these under proper management.

Depending upon the soil characteristics and local climate, soils in this class may be well or poorly suited to woodland. They are not suited to any of the common cultivated crops; in unusual instances, some soils in this class may be used for special crops under unusual management practices. Some areas of class VII may need seeding or planting to protect the soil and to prevent damage to adjoining areas.

Class VIII - Soils and land forms in class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible.

Limitations that cannot be corrected may result from the effects of one or more of the following: (1) erosion or erosion hazard, (2) severe climate, (3) wet soil, (4) stones, (5) low moisture capacity, and (6) salinity or alkali.

Badlands, rock outcrop, sandy beaches, river wash, mine tailings, and other nearly barren lands are included in class VIII. It may be necessary to give protection and management for plant growth to soils and land forms in class VIII in order to protect other more valuable soils, to control water, or for wildlife or esthetic reasons.

Geology - The area drained by Great Creek is underlain by a complex of deep-seated acidic and basic igneous and metamorphic rocks. The main


GEOLOGIC MAP
ROCK TYPE
LATE PALEOZOIC
GRANITE (Petersburg)
EARLY PALEOZOIC
GRANITE GNEISS (Formerly Wissahickon)
PRE-CAMBRIAN
SERICITE SCHIST (Slate Belt)

Fig. 3

rock type is the Petersburg granite. Also present are granite gneiss, sericite schist, diorite, and amphibolite. The Petersburg granite and associated igneous rocks are late Paleozoic in age 1/. The granite gneiss and amphibolite formerly considered part of the Wissahickon Formation are early Paleozoic or late Precambrian and the sericite schist is Precambrian - probably the oldest rock in the watershed. The rocks are generally deeply weathered with a thick mantle of residuum except at scattered outcrops and along the stream, where bedrock is found in many places.

Topography - The topography of the watershed is classified as rolling, typical of the lower Piedmont Physiographic Province. Elevations range from about 460 feet above sea level in the headwater ridges to 157 feet above sea level in the channel at the confluence with Roses Creek.

Climate - Temperatures in the area average about 40 degrees Fahrenheit in winter and 77 degrees in summer. Sub-zero temperatures occasionally occur as overnight lows, but very few days have below freezing temperatures for 24 hours straight. Sometimes during summer hot spells the daytime high temperature will reach 100 degrees or more, but this condition will last only a few days at a time. The lowest official temperature recorded in the area is 2 degrees below zero, and the highest is 107 degrees 2/. The average growing season is about 185 days, from mid-April to late October.

Annual precipitation is about 43 inches, of which about 23 inches normally occurs as rain between the first of April and last of September. The remaining 20 inches normally falls as rain or snow between the first of October and last of March 2/. Floods have been recorded in all months. Some of the most troublesome floods are caused by storms of tropical origin which frequently pass through the area in late summer and early fall, often causing widespread damage to roads, businesses in Lawrenceville, and to maturing grain and forage crops.

Mineral Resources - Brunswick County is in the Piedmont Physiographic Province and is underlain by igneous and metamorphic rocks. During 1971, quarries were operated in granitic rock near Lawrenceville, Rawlings, and Dolphin 3/. The stone was crushed for road stone, ballast, concrete aggregate, and other uses. Clay and schist are mined near Lawrenceville for the manufacture of brick.

In the past, granitic rocks were also quarried near Alberta for crushed stone and near Brunswick for construction stone. Granite from the quarry near Rawlings was used as heavy riprap in construction of the Chesapeake Bay Bridge Tunnel. Clay was formerly produced near Brodnax for bricks. Clay materials at other localities in the county are potentially suitable for various ceramic products.

1/ Division of Mineral Resources, 1963, Geologic Map of Virginia.
2/ A Handbook of Agronomy, Publication 600, Extension Division, V.P.I. and State University, Revised January 1974.
3/ Data Summary - Brunswick County, Virginia, Division of State Planning and Community Affairs, July 1972.

Ground Water - The water table is generally within 40 feet of the ground surface. Shallow, large-diameter dug or bored wells may furnish supplies sufficient for domestic use 1/. Major problems with these wells are the threat of decreased yield during prolonged droughts and the danger of possible contamination from nearby surface sources. The bedrock is essentially impervious and collects very little ground water except in sizable fractures. The occurrence of fractures is difficult to predict, but because they decrease in size and number with depth, drilling deeper than 300 feet has seldom increased the yield of wells. Wells should be located at lower elevations, where bedrock may be weaker due to fracture zones and where more recharge is available.

Land Use - Currently, 22,815 acres (77 percent) of the watershed is in forest land, 3,662 acres (12 percent) is in cropland, 2,949 acres (10 percent) is in pasture, and about 328 acres (1 percent) is in other uses such as buildings, roads, utilities, and odd areas. There are no federal lands in the watershed. (See table on page 22).

Principal crops grown in these flood plains and surrounding uplands are corn, small grain, silage, soybeans, and hay.

1/ Data Summary - Brunswick County, Virginia, Division of State Planning and Community Affairs, July 1972.

LAND USE BY LAND CAPABILITY CLASSES
In Watershed Only

Above Proposed Structure in Flood Plain		Acres in Each Use				
Land Capability Class	Percent of Total in each class	Cropland	Pasture land	Forest Land	Other	: Total : Acres
II	7.56	35	0	45	0	80
III	11.82	0	2	123	0	125
IV	80.62	0	0	853	0	853
Total Acres		35	2	1021	0	1058
Percent of Total in Each Land Use		3.31	0.19	96.50	0	100

In Watershed Only

Below Proposed Structure in Flood Plain		Acres in Each Use				
Land Capability Class	Percent of Total in each class	Cropland	Pasture land	Forest Land	Other*	Total Acres
II	5.23	1	0	23	0	24
III	10.46	0	3	45	0	48
IV	84.31	32	23	304	28	387
Total Acres		33	26	372	28	459
Percent of Total in Each Land Use		7.19	5.66	81.05	6.10	100

* Sewage Plant 3 Ac.
Old Brick Mine Pits 8 Ac.
Roads 1 Ac.
12 Ac.
Other Misc. 16 Ac.
Total 28 Ac.

LAND USE BY LAND CAPABILITY CLASSES

Below Watershed Only

Flood plain lands on Great Creek below junction of Roses Creek and Great Creek

Land Capability Class	Percent of Total in each class	Acres in Each Use				
		Cropland	Pasture land	Forest Land	Other	Total Acres
II	5	12	0	3	0	15
III	10	0	30	0	0	30
IV	85	0	0	260	0	260
Total Acres		12	30	263	0	305
Percent of Total in Each Land Use		3.93	9.84	86.23	0	100

Stream Pattern - Great Creek, an unmodified, well-defined stream, originates approximately 1.5 miles west of the Brunswick-Lunenburg County line in Lunenburg County near the intersection of Virginia Highways 616 and 137. The stream bottom elevation ranges from about 460 feet above sea level along the headwater ridges to 137 feet above sea level in the channel at the confluence with the Meherrin River. The stream gradient averages 6.7 feet per mile.

The project area portion of the Great Creek watershed is relatively long and narrow with the creek being about 20 miles long through the project area. The stream flows in an east-southeasterly direction with the project area being approximately 4 miles wide; then it turns in a south-southeasterly direction with the project area gradually tapering to about 1 mile in width. (See Project Map.)

About 39 miles of perennial streams and 79.5 miles of intermittent streams are in the project area. There are seven perennial tributaries draining into Great Creek. There are four within the watershed boundary: Becky Branch, Powell Creek, Tea Branch, and an unnamed tributary which joins Great Creek between Interstate 85 and U.S. Highway 1. Roses Creek, Sandy Branch, and Stevens Branch join Great Creek below Lawrenceville and are outside of the project boundary. Numerous unnamed, intermittent drainageways join Great Creek over its entire length. These tributary drainage areas range from about 2 square miles to less than 1/2 square mile.

The 10-year, 7-day low flow is 0.0065 cfs/square mile which is equivalent to 0.17 m.g.d. at the structure site. This figure is considered accurate for all points along Great Creek between the proposed dam and the lower end of the project area.

One hundred ponds are in the watershed, constructed primarily to provide livestock water, incidental fishing, and other forms of recreation to owners and their permitees. The Dixon Millpond is the largest lake in the project area; it occupies about 9 acres and is used for private fishing.

Water Quality - According to the Commonwealth of Virginia Water Quality Standards, the Meherrin River and its tributaries in Virginia from the Virginia-North Carolina state line to its headwaters are classified as Class III-A 1/. The III-A definition is: "The waters generally satisfactory for use as public or municipal water supply, secondary contact recreation, propagation of fish and aquatic life, and other beneficial uses."

Data collected March 20, 1972 at the raw water sample pipe at the Great Creek raw water pump station indicates the water is of good quality even though it is high in iron and manganese 2/. Mean daily flow for this date was 40 cfs, or about normal.

Data collected in three samples close to the damsite location was analyzed in February 1975 3/. Test results are shown in Appendix G. These samples also indicate that the water is of good quality. There is no industrial or point pollution in the watershed.

The consultants have monitored the quality of the stream flow of Great Creek 4/. An analysis of the parameters considered and tested are in Appendix G.

1/ Virginia State Water Control Board, 1974, Commonwealth of Virginia Water Quality Standards.

2/ Data collected on March 20, 1972, and received in Water Plant Laboratory March 22, 1972 as published by the Virginia Department of Health, Bureau of Laboratories, Laboratory No. 10-235.

3/ Date provided by the Commonwealth of Virginia, State Water Control Board.

4/ Gilbert W. Clifford and Associates, Inc., Engineers-Land Planners, Fredericksburg, Virginia.

PRESENT AND PROJECTED POPULATION

According to the U.S. Bureau of the Census 1/, the 1970 population of Brunswick County was 16,172, and Lunenburg County, 11,687. Both counties have recorded a population decline each census since 1950 1/. Projections for the area made by the Virginia Division of Planning and Community Affairs indicate this trend will continue at a decreasing rate for another 20 to 25 years; stabilizing by about the year 2000 at about 14,500 in Brunswick County and 10,800 in Lunenburg 2/. Brunswick is adjacent to the rapidly urbanizing Dinwiddie County. With the planned expansion of public water systems, other utilities, and the relatively easy access to the Richmond - Petersburg metropolitan areas, these population projections may be found to be very conservative. The Dinwiddie population increased 12.9 percent between 1960 and 1970.

The present population of the watershed is estimated at 1,690. Of these, about 1,090 live in that portion of Lawrenceville within the watershed, and another 125 are rural non-farm residents living on small tracts. The present farm population is estimated at 475. The proposed project will encourage population centers which can be efficiently serviced with water, and sewer services, and other necessary utilities; and at the same time retain relatively large areas in a rural environment.

ECONOMIC RESOURCES

Most of the watershed is privately owned and, except for the town of Lawrenceville, is mostly in agricultural and forestry use. The largest single area in public ownership is Christianna Campus of Southside Virginia Community College, consisting of approximately 109 acres. The other public lands consist of highway rights-of-way and small areas owned by Brunswick County and the town of Lawrenceville for public buildings. There are no federally-owned lands in the project area.

The economy of the area has always been based primarily on agriculture. Although income from crop production accounts for nearly two-thirds of the farm sales, income from livestock production has made significant gains in recent years and now provides about 30 percent of the farm income. The production of lumber and other forest products continue to be important to the county's economy, with a number of local sawmills and concentration yards in operation. In 1969, sale of forest products provided about 4 percent of the total farm income.

1/ U.S. Bureau of the Census, Washington, D.C., Census of Population, 1950, 1960, 1970.

2/ Virginia Division of State Planning and Community Affairs, Richmond, Virginia - Statistical Information Series No. 72-2, Population Projecting to 1980, 1990, 2000, 2010, and 2020 for Virginia Counties, Cities, and Planning Districts.

There are 179 farms in the watershed, ranging in size from less than 10 acres for some of the part-time operations to 738 acres for the largest unit; the average size is about 101 acres. Production levels for crops grown in the watershed reflect the flood hazard and the necessity of using marginal upland for some crops for onfarm use. Current production levels per acre are 65 to 90 bushels of corn, 40 to 60 bushels of barley, 20 to 25 bushels of soybeans, 1,700 to 1,800 pounds of tobacco, 1,250 to 1,700 pounds of peanuts, 10 to 15 tons of silage, 1.5 to 3.0 tons of hay, and pasture providing 3.7 to 6 animal unit months of grazing. With the existing flood hazard, the bottom land soils yield about 80 bushels of corn, 45 bushels of barley, 20 bushels of soybeans, 2.5 tons of hay, 4 animal unit months grazing of pasture, and 15 tons of silage. No attempt is now made to grow tobacco in the flood plain due to the flood hazard.

Present forest stands occupy 77 percent of the watershed. The stands are 38 percent hardwoods (red, white, black, chestnut, post, and scarlet oaks along with yellow poplar, sweet gum, black gum, beech, red maple, hickory, and sycamore), 33 percent mixed stands (hardwood species in mixture with loblolly, shortleaf, and Virginia pine), and 29 percent pure pine stands including loblolly, shortleaf, and Virginia pine. A small amount of eastern red cedar is found scattered in all areas. Approximately 42 percent of the forest stands are of sawtimber size having a volume of 1,500 board feet per acre or more; 35 percent are of pole-size timber having a volume of 500 cubic feet per acre or more, and 23 percent seedlings and sapling-size stands.

Local markets are good for most forest products and all of the timber stands are readily accessible from a network of state, county, and private roads.

All of the forest land is in private ownership with forest industries owning several tracts within the watershed.

Forest fire protection is provided by the Virginia Division of Forestry in cooperation with the U.S. Forest Service, through the Clark-McNary Cooperative Forest Fire Control Program (C-M2), assisted by local volunteer fire companies. Other ongoing Federal-State cooperative forestry programs include: Cooperative Forest Management (CFM), Cooperative Forestation (C-M4), and Cooperative Insect and Disease Control.

Given protection, care, and management, the forest stands will contribute considerably to the future overall economy of the watershed.

Land values, exclusive of buildings, currently range from $75 to $1,000 per acre depending on location, accessibility, availability of utilities, use, and development costs. Flood plain land values are usually estimated at $100 to $300 per acre if included as a part of tracts with usable upland.

The entire watershed is easily accessible from a network of primary and secondary highways. U.S. Highway 58 traverses the southern area

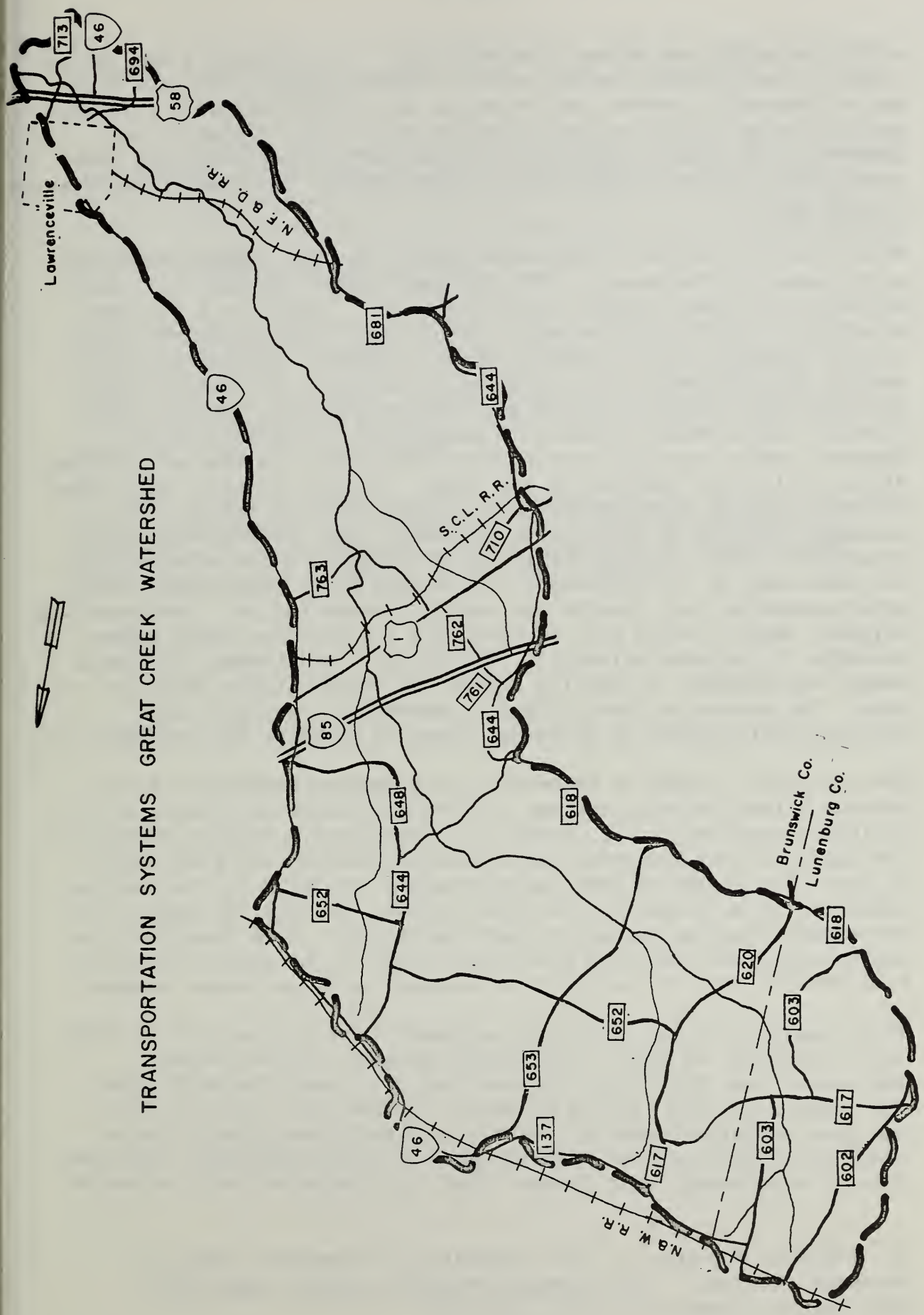

TRANSPORTATION SYSTEMS GREAT CREEK WATERSHED
Lawrenceville
N.F.B.D. R.R.
S.C.L. R.R.
N.&W. R.R.
Brunswick Co.
Lunenburg Co.
46
58
85
1
713
694
681
644
763
710
762
761
648
618
652
620
603
653
137
617
602

Fig. 4

of the watershed and serves Lawrenceville. U.S. Highway 1 and Interstate 85 traverse the central area of the watershed. Virginia Highway 46 generally borders the watershed in a north-northwest direction, serving Lawrenceville and providing access to U.S. Highway 1 and Interstate 85. These highways and other all-weather secondary roads provide easy access to all parts of the nation. (See the transportation systems map).

Motor freight service is available daily, with nationwide connections at Richmond and Petersburg. The Seaboard Coast Line Railroad runs northeast-southwest through Brunswick County. There is a terminal at Alberta, about 2.5 miles east of the Great Creek watershed, providing transportation to points north and south. The Norfolk and Western Railroad also has a terminal in Alberta. It connects this area with the eastern seaboard and with the Midwest. The Norfolk, Franklin and Danville Railroad, a subsidiary of the Norfolk and Western, passes through Lawrenceville and serves the southern portion of the state from Danville to the coast. Interconnections with other railways provide transportation to all parts of the nation. Bus passenger service is provided by Greyhound Lines with several daily schedules through Lawrenceville, and at Alberta, a few miles east of the watershed on U.S. Highway 1. This line makes connections with other schedules that furnish nationwide transportation. Lawrenceville airport, about 3 miles east of town, has a 3,200-foot paved runway suitable for private aircraft. This field is unattended, but has a hangar and provides a rotating beacon and runway lights from dusk to dawn. The nearest airport offering commercial service is Byrd International Airport at Richmond, about 65 miles to the northeast 1/.

The per capita income in Brunswick and Lunenburg Counties was 45 percent below the state average in 1960 and almost 40 percent below in 1970, according to U.S. Bureau of Census data. Over 60 percent of the farms in both Brunswick and Lunenburg Counties had gross sales of less than $5,000 in 1964; approximately one-third of the counties' families had an income of less than $3,000. In 1970, 25 percent of the families had an income of less than $3,000. Even though the per capita income in this area grew faster than in the state as a whole from 1965 to 1969, it was still 45 percent below the state average.

Farm ownership by the operators increased from 39.6 percent in 1964 to 61.8 percent in 1969. During this period, the part-owners decreased from 29.4 to 25.6 percent and the tenant-operated farms decreased from 31.0 to 12.6 percent. In 1964, over 14 percent of the farm operators under 65 years of age had gross sales of less than $2,500 and had less than 100 days off-farm employment opportunities to supplement their income. The civilian work force increased

1/ Virginia Division of State Planning and Community Affairs; Richmond, Virginia - Data Summary Brunswick County, July 1972; Data Summary Lunenburg County, May 1972.

from about 30 percent of the population in 1960 to about 40 percent in 1974. Unemployment ranged from 4.8 to 4.2 percent of the work force during this period.

Forty-five of the 179 farms in the watershed are classified as part-time operations, with the remaining 134 being full-time farms. A part-time farm operation is described in the U.S. Census of Agriculture as one on which the annual gross sales was less than $2,500, the operator was under 65 years of age, and he worked more than 100 days off the farm during the census year.

Nearly all of the farms are single-family, owner-operated units, with day labor hired as needed to harvest crops. A few of the larger operations employ both day labor and full-time employees who live on the farm and are paid a monthly salary. In recent years about 45 percent of the farm families found it necessary to supplement their income with off-farm employment.

Electricity and telephone service are available to all parts of the watershed. Commonwealth Gas Distribution Corporation supplies natural gas to Lawrenceville and nearby Brunswick County areas. Natural gas is not available in Lunenburg County.

PLANT AND ANIMAL RESOURCES

Great Creek watershed supports a wide variety of plant communities. Currently, 22,815 acres are in forest land, 3,662 acres are in cropland, 2,949 acres are in pastureland, and approximately 328 acres are in other uses such as homes,yards, odd areas, buildings, roads, and utilities. Such plant communities as annual plants, grasses and legumes, shrubs, hardwoods, and coniferous trees provide elements of wildlife habitat. Terrestrial wildlife habitat is based on the quality and quantity of the vegetative communities. This watershed has a variety of vegetative communities in various stages of succession. The 3,662 acres of cropland is well distributed throughout the watershed. It provides a variety of plants including annual weedy plants, grain and seed crops, and a variety of grasses and legumes for hay. Approximately 200 acres are idle each year.

Both wild and cultivated annuals require bare soil in which to become established, and produce abundant, long lived seeds. Therefore, annuals fit into the early stages of plant succession and provide an important food source for varied wildlife species. The most valuable wildlife food provided by the cultivated annuals is corn, followed closely by wheat, milo, oats, and soybeans. Among the wild annuals which provide wildlife food are barnyard grass, lambsquarter, ragweed, foxtail, pigweed, chickweed, and smartweed. Characteristic wildlife species of openland are blackbirds, meadowlarks, mourning doves, sparrows, and finches. Other species of wildlife which use open, cultivated, or weedy areas, but are dependent upon a mixture of vegetative types, are bobwhite quail, cottontail rabbits, gray fox, shrews, and meadow mice.

Grasses and legumes planted for hay provide a very important element of wildlife habitat. They provide nesting and other types of dense, low wildlife cover and furnish food for a wide variety of mammals and birds in particular situations. There are very few spots in the watershed where grasses represent the climax vegetative community. Therefore, whether natural or planted, grasses and legumes make up a very unstable and short-term plant community unless well cared for.

There are 2,949 acres of pastureland in the watershed. Practically all grasses and legumes have some erosion control and wildlife habitat values. Fescue, bluestem, and orchardgrass provide nesting areas for field sparrows, meadowlarks, bobwhite quail, cottontail rabbits, meadow mice, and short-tailed shrews. Whitetail deer, wild turkeys, bobwhite quail, meadowlarks, field sparrows, and cottontail rabbits feed on the tender growth of a wide variety of grasses and legumes as well as the associated small seeds and insects. Grass and legume areas are more valuable and useable to wildlife if woody vegetation is nearby.

Within the watershed, shrubs become a component of the plant community during the ecological process of succession. This is a natural process which is continuously attempting to take place when man-made or agronomic communities are substituted for the natural forest. The shrubs occur in the intermediate or unstable community of annuals and mixed herbaceous perennial plants. Shrubs also are an element of tree communities, forming distinct layers in forest lands. Usually, different shrub species are represented in these two situations.

In shrub stages of plant succession, there is considerable variation in the ability of different species to maintain themselves. Some, such as dewberry, blackberry, and raspberry are dominant for a relatively short period. They are replaced by dogwoods, sumac, elders, hazelnut, and other species which are intermediate in span of dominance. Flowering dogwood, hawthorn, and redbud are late-stage plants that persist in abundance even after trees have become dominant. Shrubs seem to fall in the following categories, successionally:

Early Stages	Mid Stages	Late Stages
dewberry	hazelnut	flowering dogwood
blackberry	poison ivy	hawthorn
raspberry	sumac	redbud
blueberry	honeysuckle	spicebush
huckleberry	elder	shadbush

Many forms of wildlife in the watershed find the shrubs a valuable source of food and cover. Included are the whitetailed deer, bobwhite quail, woodchucks, jays, thrashers, robins, cardinals, and cedar waxwings.

Trees occupy the final stage of plant succession in this watershed. They have a high degree of stability and major changes are relatively slow unless disrupted by man's activities such as logging, burning, or grazing. Trees provide dens, nest sites, seeds, fruits, buds, and nuts valuable for a wide variety of wildlife species. The eastern red cedar and loblolly, shortleaf, and Virginia pine provide habitat for thrushes, pine warblers, whitetailed deer, gray squirrel, eastern chipmunk, mice, and cottontail rabbits. Mixtures of conifers and hardwoods such as oaks, hickory, black walnut, holly, wild cherry, and ash are more valuable to wildlife than pure stands of any single tree species. Wildlife associated with the mixed coniferous and hardwood forest are whitetailed deer, opossum, raccoon, gray fox, gray squirrel, brown thrasher, cardinal, woodpecker, wood thrush, and red-eyed vireo.

See Appendix E for lists of flora and fauna commonly found in the watershed.

Great Creek and its tributaries are warm water streams with low fish populations and little fishing pressure. Elevations range from about 460 feet above sea level along the headwater ridges to 137 feet in the channel at the confluence with the Meherrin River. The stream flows southeasterly from its source to its outlet, with a relatively uniform gradient averaging 6.7 feet per mile.

There are seven perennial tributaries draining into Great Creek. Four are within the watershed boundary: Becky Branch, Powell Creek, Tea Branch, and an unnamed tributary which joins Great Creek between Interstate 85 and U.S. Highway 1 (see Project Map for locations). Roses Creek, Sandy Branch, and Stevens Branch join Great Creek below Lawrenceville and are outside of the project boundary. There are numerous unnamed, intermittent drainageways joining Great Creek for its entire length. Water quality is good with no known industrial or point source of pollution in the watershed. Streambanks gradually increase in height from 3 feet at the junction of Tea Branch to 6 feet at the Highway 763 crossing. Bank height does not increase from here downstream, but the channel width does increase until it is between 27 and 32 feet wide at the damsite, depending on where cross sections are taken. Water depths varied from as little as 2 inches deep in some riffles to as much as 3 feet deep in some holes. Water temperatures ranged from 39° F in the winter to 82° F in the summer. The creek bottom is sand mixed with silt, with very little gravel and an occasional rock over 6 inches in diameter. The banks are mostly vertical or nearly so, and well shaded their full length. Riffles and pools are few except at very low flows.

The main stem of Great Creek was sampled for fish and benthic organisms. Samples were taken until no new species were found. A total of 25 fish species were collected, including brook lamprey, American eel, chain pickerel, chubs, shiners, suckers, bullheads, pirate perch, sunfish, bass, and darters. A 100-yard section at Highway 763 was sampled with an electric shocker. Three runs were made and 159 fish were counted which weighed a total of 3 lbs. 12 ounces.

Benthic organisms were also diversified and varied. They include fresh water snails, muscles, crayfish, and 15 different genera of aquatic insects. Reptiles and amphibians such as bullfrogs, water snakes, mudpuppies, salamanders, and snapping turtles have been observed. Refer to Appendix E for a listing of biota.

Fishing access is very limited along Great Creek except in the town of Lawrenceville near the city water intake and where public roads cross Great Creek. The only fisheries resource of significance to anglers is provided by the abandoned clay pits in Lawrenceville and the 100 farm ponds located in the watershed.

Deer populations have been gradually increasing in recent years, varying between 5 and 15 animals per square mile, depending on local habitat. Wild turkey numbers are less than one adult bird per square mile. Population figures are not available on other species; however, rabbit, gray squirrel, quail, muskrat, raccoon, beaver, groundhog, gray fox, and opossum are common throughout the watershed.

There are two swampy areas in the upper drainage of Great Creek. The first area is upstream from Interstate 85, and consists of approximately 4 acres of Type 1 1/ wetland seasonally flooded wooded bottom land. The second area, consisting of approximately 10 acres, lies immediately above Dixon millpond. This marsh has developed in the upper end of the millpond from trapped sediment and emergent aquatic weed growth. It varies from wet meadow areas to deep open water of the millpond itself. This in turn is surrounded by woodland. Waterfowl, especially wood ducks, feed and nest in this area. Other waterfowl use these areas and the farm ponds as resting and feeding stops in their fall and spring migrations. An occasional mallard will also nest along these ponds where suitable habitat exists.

Hunting pressure is low to moderate, and there is no land open to public hunting. The watershed presently supports good populations of nongame birds and mammals. About 45 species of songbirds are common throughout the watershed. Habitat conditions are excellent: a mixture of cropland, grassland, forest land, and odd areas such as railroad and powerline rights-of-way provide good mix of habitat.

There are no known rare or endangered animal or plant species within the Great Creek watershed.

RECREATIONAL RESOURCES

No facilities have been developed or are operating for public outdoor recreation within this project area. Most of the land is posted with access for hunting and fishing limited by the landowners to local residents or friends on a day-to-day basis. Plans for developing public accessibility and facilities are discussed under Planned Project.

Recreation facilities open to the public within Brunswick County and closely adjacent areas include:

1. Lake Gaston:

   Lake Gaston is a 20,300-acre 2/ reservoir on the Roanoke River located on the southern boundary of Brunswick County. The reservoir is operated by the Virginia Electric and Power Company with motor boating and fishing allowed. Being a reservoir on a river system, a large variety of warm water fish species are available to the angler.

1/ Shaw, S.P., and Fredine, C.G. 1956. Wetlands of the United States. Fish and Wildlife Service, United States Department of the Interior, Circular 39.

2/ Small portion only in Brunswick County.

2. Camp Pickett Reservoir:

Camp Pickett reservoir is a 381-acre impoundment on the Nottoway River and is located in the northwest corner of Brunswick County. The reservoir is owned and operated by the U.S. Army. Public fishing is allowed. Being a reservoir on a river system, a large variety of warm water fish species are present. Portions of Camp Pickett are also open by permit for hunting in season.

3. Brunswick County Pond:

The Virginia Commission of Game and Inland Fisheries owns and operates this 142-acre impoundment on Reedy Creek. Largemouth bass, bluegill, redear (shellcracker), and channel catfish are stocked. These plus native species from Reedy Creek are available for public fishing.

4. Delbridge Campground and Marina:

Delbridge Campground and Marina is a privately owned and operated overnight campground on the shores of Lake Gaston. Overnight camping, boat ramp, boat storage, moorings, picnicking, and swimming beach are available.

5. Union Camp Hunting Area:

Union Camp of Franklin, Virginia, open 16,000 acres of their land to hunting by special permit only.

ARCHEOLOGICAL, HISTORICAL, AND UNIQUE SCENIC RESOURCES

A careful check and review of the National Register of Historic Places was conducted; no listing was found for the watershed area. The Virginia Historic Landmarks Commission was consulted and they made a map study and conducted an investigation and the following information on places of historic interest was given:

Millville - A late 18th or early 19th century plantation complex. This place is eligible for the National Register of Historic Places. (Located about 1 mile southeast of U.S. Route 1 on State Highway 763.)

The state archeologist was consulted and he stated, "I have searched my files and find no record of archeological sites in the area of the project. From my previous knowledge of the area and from a detailed study of the USGS topographical map (Alberta 7-1/2 minute Quadrangle Sheet), I am confident that there are no significant archeological remains in the affected area." 1/

The National Park Service was notified with respect to the project in compliance with the National Historic Preservation Act of 1960 (80 Stat. 915) and Public Law 86-523, 86th Congress S. 1185, 1970.

1/ Letter from State Archeologist, January 17, 1975.

The scenic values of the watershed are those of a pleasant rural environment, typified by low rolling hills covered by deciduous and mixed pine forest, interspersed by crop and pastureland.

St. Paul's College, formerly St. Paul's Polytechnic Institute, at Lawrenceville, was founded in 1888. It was the third oldest Negro vocational and industrial school in the United States. St. Paul's is now a fully accredited college. It offers Bachelor of Arts and Bachelor of Science degrees. The Christianna Campus of Southside Virginia Community College, located near Alberta, is the community college for the county. These two colleges are of cultural and historical importance.

SOIL, WATER, AND PLANT MANAGEMENT STATUS

Recent emphasis on livestock and dairy operations has tended to increase the acreage of forage crops and pasture in this watershed. Sale of field crops accounted for about 80 percent of the agricultural income in 1964, and about 66 percent in 1969. Livestock and their products accounted for about 16 percent of the income in 1964 and 30 percent in 1969.

Future land use will show a gradual shift from the marginal cropland into pasture and forage production for livestock. The remaining, more productive cropland will be more intensively farmed to meet the demand for field crops such as wheat, corn, and soybeans.

Land cover conditions are good to fair, with small scattered areas on some of the farms in need of special conservation practices. Sixty-seven percent of the 179 farms have cooperative agreements with the Southside Soil and Water Conservation District. All cooperators have installed conservation measures. Sixty-five operators have developed plans for their entire units, and the remaining 55 are in the process of developing complete plans. Approximately 80 percent of the practices planned to date have been applied.

PROJECTS OF OTHER AGENCIES

The Emporia, Virginia, water supply reservoir is on the Meherrin River downstream from Great Creek. This facility supplies municipal and industrial water to Emporia and a portion of Greensville County adjacent to the city. The proposed Great Creek watershed project, including both structural measures and accelerated land treatment, will reduce sediment leaving the watershed by 15,433 tons annually, and will reduce the amount delivered to the Emporia reservoir by 7,717 tons annually.

Long range plans for Brunswick County call for the establishment of a water authority which will develop the water resources of Great Creek as an integral part of a county-wide water supply and distribution system. Present plans are to utilize the one million gallon per day water treatment plant in the town of Lawrenceville, and to upgrade the distribution system in order to provide better service. The initial expansion would extend service north and south from Lawrenceville along State Highway No. 46, and east and west of the town along U. S. Highway No. 58. Lines would also extend northeast and southwest along U. S. Highway No. 1 from its junction with State Highway No. 46.

On the basis of test results, conventional treatment processes should be effective in treating the water of Great Creek. The present treatment process consists of coagulation, sedimentation, filtration, and chlorination.

To meet current and future needs, the present water treatment plant (one million gallons per day capacity) will need to be expanded to three and one-half million gallons per day by 2000.

The present water distribution system including storage tanks, pumping stations, and water mains will be updated to meet the requirements of the expanded service area. The lines will be sized to provide adequate fire flow as well as maximum domestic demand resulting from future growth within the county. The spacing of fire hydrants will be based on recommendations of the National Board of Fire Underwriters.

The Federal Insurance Administration's September 30, 1974 list of areas (communities) which have applied for and are participating in the National Flood Insurance Program includes both Brunswick County and the town of Lawrenceville. The FIA Flood Hazard Boundary Map, published by the Department of Housing and Urban Development, has only been prepared for the town of Lawrenceville. These two communities are included in the "emergency program" at this time, since detailed flood insurance studies are required to qualify them for the "regular program."

There are no other existing or proposed projects of other agencies within or outside the watershed which would be affected by the proposed works of improvement.

WATER AND RELATED LAND RESOURCE PROBLEMS

LAND AND WATER MANAGEMENT

As late as the early 1940's, gully and sheet erosion were major problems in large areas of this watershed. Up to 75 tons of sediment per acre per year were lost due to this cause. In recent years, conservation land use planning by landowners and the increased installation of conservation land treatment measures have decreased soil loss. Land treatment measures are still needed on certain areas throughout the watershed to realize the land use potential of the watershed. These needed adjustments appear to be within the financial capability of the landowners with the assistance available through current conservation programs. Measures needed include such practices as minimum tillage, crop residue management, conservation cropping systems, pasture and hayland management, pasture planting, grassed waterways, ponds, field border plantings, tree planting, forest stand improvement measures, and recreational area development. A continuing effort is being made to encourage additional application of conservation measures by landowners and operators. As a basis for providing sound technical assistance, soil survey information is needed on 19,310 acres. Providing landowners with accelerated technical assistance in establishing needed land treatment measures will be a major factor in the installation of an overall watershed management program.

FLOODWATER DAMAGE

Runoff from storms of the 5-year frequency magnitude block the road approaches to 3 of the 12 bridges in the watershed, and inundate three-fourths of the 100-year frequency flood plain. The 100-year frequency storm runoff blocks 14 of the 16 roads in the flood plain. Flows from large storms also carry debris, sediment, and other contaminants which cause various problems.

The water supply intake for Lawrenceville is located directly west of the Lawrenceville Brick and Tile Company (in the upstream end of Reach E), and is affected by both high and low flows in Great Creek. The sewage treatment and disposal plant for Lawrenceville is located in the downstream end of Reach E (see project map). The functioning of this utility is affected by storm flows of the 15-year and larger storms; often requiring quick emergency action to prevent or minimize serious damage to the plant and equipment.

Health hazards often arise when deposits from flood flows are left on the flood plain and road crossings. Flood-blocked roads cause economic losses to residents from either long detours to market or loss of income because places of employment cannot be reached.

One of the most damaging storms in recent years occurred in October 1972. It produced stages at some locations exceeding those expected from a storm occurring once in 100 years. This storm caused damage estimated at $270,000 to flood plain improvements and agricultural interests in this watershed (see figures 5 through 10).

Fig. 5 Storm of Oct. 1972 damages in Lawrenceville

Fig. 6 Storm of Oct. 1972 damages in Lawrenceville

Fig. 7 Storm of Oct. 1972 flooding of sewage disposal plant

Fig. 8 Storm of Oct. 1972 damages adjacent to Great Creek

Fig. 9 Storm of Oct. 1972 flooding on U.S. Highway 58 Lawrenceville by-pass

Fig. 10 Storm of Oct. 1972 road damage

Other severe storms occurred in August 1940, July 1945, December 1948, June 1949, November 1952, August 1955, July 1959, June 1966, and June 1972.

The 100-year frequency storm runoff inundates 764 acres on Great Creek below the proposed structure, with 81 percent of the area inundated by the 10-year frequency storm runoff. Almost none of the agricultural flood plain can presently be managed to produce to its potential. Average annual damages to crops and pasture amount to $1,200.

Agricultural improvements currently in the flood plain consist chiefly of farm roads, fences, and a few small structures which vary somewhat in their susceptibility to damage. The average annual damages to these improvements amount to $4,480.

There are 12 highway bridges, 4 fords, and about 1 mile of roads in the flood plain of the project area. Average annual damages to these improvements amount to $4,035, exclusive of loss of income, cost of rerouting, and traffic delays during floods.

There are 12 commercial properties in Lawrenceville and the town's municipal water plant and sewage treatment plant in the flood plain of this watershed. The severe storms inundated these properties to depths up to 5 feet. In addition to damage to the properties and destruction of merchandise the businesses were closed for one day to two weeks for clean-up and restocking. This resulted in loss of sales and income to the operators and their employees. Average annual damage to these improvements are estimated to be $15,105 annually.

Indirect economic losses due to loss of salaries and sales from flooded businesses, long detours to market, or loss of income because places of employment cannot be reached and other associated losses are estimated to be $11,290 annually.

EROSION DAMAGE

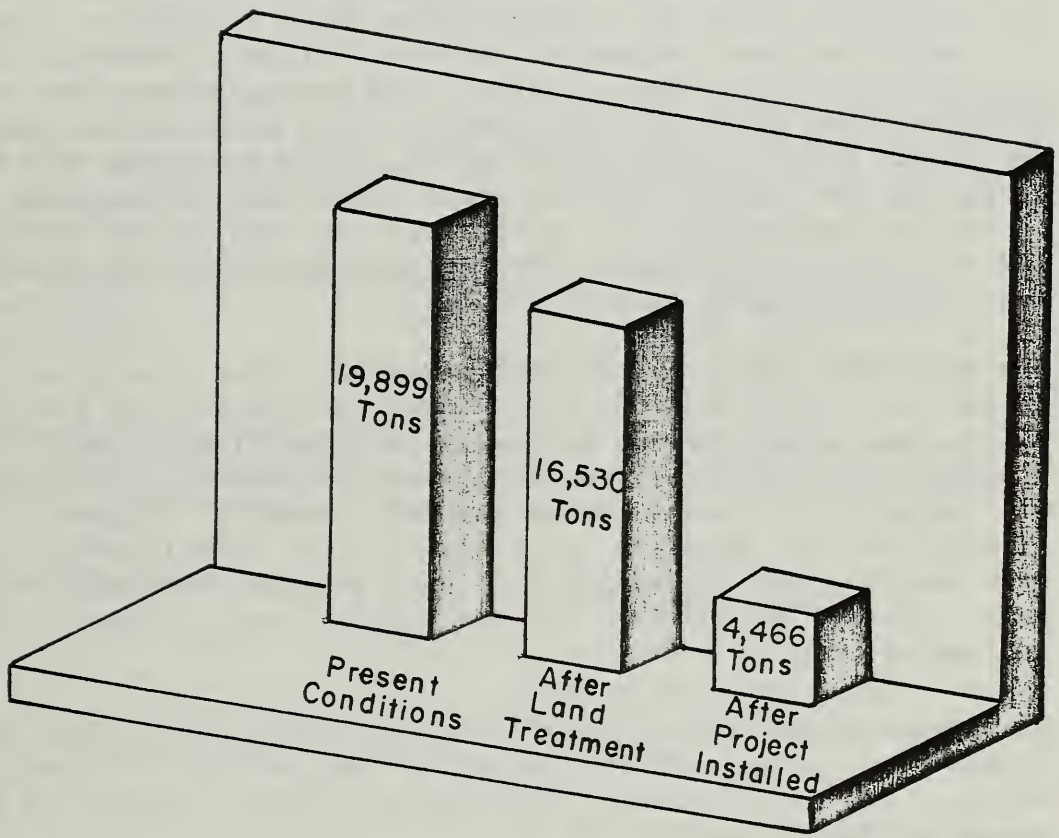
Because of farming practices and soil types, erosion of the upland has been a very serious problem in the past. In recent years land use changes and applied conservation measures have reduced the problem considerably. Several factors, when considered together, make upland erosion a continuing problem. Among these are untreated road cuts and fills, sheet erosion on cropland, overgrazing of pastures, poor overall hydrological condition of forest land, and poor logging practices in harvesting forest products. Sheet erosion on cropland, as computed by accepted Soil Conservation Service criteria, is about 16 tons per acre per year, and estimated values for other uses show an average on all land of about 4.2 tons per acre per year. The cropland producing the greatest amount of sediment in the watershed is the 2,087 acres in land capability class II, the 806 acres in class III, and 366 acres in class IV. Erosion rates from untreated road cuts and fills can exceed 100 tons per acre per year.

SEDIMENT DAMAGE

Frequent flooding leaves deposits of fine-grained sediment over rather large areas, and coarser materials at localized areas of flood plain. These coarse, infertile deposits damage the land and reduce production and income for the landowners. The finer sediment deposited over large areas causes less damage to productivity. Sediment deposition has reduced the productive capacity of 36.5 acres of flood plain land. This has resulted in a 10 percent loss of income on 20.6 acres and 20 percent on approximately 15.9 acres, causing losses to landowners estimated at $540 annually. In addition floodwater often deposits fine sediment on crops at various stages of maturity, causing serious quality damage.

Sediment deposition from flood flows on roads and bridges causes added clean-up and maintenance costs and creates a safety hazard to motorists. Difficulties in vehicle control occasionally result in serious accidents. Deposits of sediment from floods reduce bridge and channel capacities and lower storage capacity of reservoirs. Such deposits also lower water quality for municipal and industrial uses, recreation, fish habitat, fishery potential, recreational boating, esthetic values, and other possible future uses.

Sediment originating in the watershed moves into the Meherrin River and eventually into the Chowan River and Albemarle Sound. Emporia Dam, operated by the city of Emporia, is on the Meherrin River downstream from Great Creek. Municipal and industrial water is supplied from this reservoir to Emporia and parts of Greensville County. Sediment delivered from Great Creek to Emporia Dam is extimated to be 9,950 tons per year. The trap efficiency of the Emporia Dam is estimated to be 70 percent. Under present conditions, approximately 2,985 tons of sediment per year from Great Creek pass the Emporia Dam and are deposited in the Chowan River or Albemarle Sound. These damages to the downstream Emporia Dam are estimated to be $32,130 annually based on sediment removal costs experienced in this area.



SEDIMENT FROM GREAT CREEK
REACHING THE MEHERRIN RIVER ANNUALLY

Fig. 11

MUNICIPAL AND INDUSTRIAL WATER PROBLEMS

At the present time, a public water supply system owned and operated by Lawrenceville furnishes water to the town and adjacent areas of Brunswick County. A water treatment plant, with a capacity of one million gallons per day, presently provides sedimentation, filtration, and chlorination for about one-third of that amount. Three elevated tanks with a total capacity of 550,000 gallons provide pressure equalization and storage. Raw water for the system is obtained primarily from Great Creek with an auxiliary supply from the Meherrin River.

The town of Alberta has its own water distribution system, including two elevated tanks with a total storage capacity of 300,000 gallons. Treated water is pumped from the Lawrenceville treatment plant through 6-inch and 10-inch lines owned by Alberta. Water for the Christianna Campus of Southside Virginia Community College is supplied by the Alberta system. The town also owns two wells which are used as an auxiliary supply. One well yields 9 gallons per minute with no treatment provided, while the other well yields 19 gallons per minute with treatment consisting of aeration, chlorination, sedimentation, filtration, and the addition of soda ash for alkalinity adjustment. Present consumption for the service area is about 50,000 gallons per day.

The only other public water supply system in the county is located in the town of Brodnax, on U.S. Highway No. 58 west of Lawrenceville. Raw water for the system is supplied from two wells with pumping capacities of 75 and 25 gallons per minute. The larger well normally furnishes the entire daily supply. Treatment consists of chlorination, aeration and filtration for iron removal and corrosion control, and the addition of soda ash for alkalinity adjustment. Present consumption for the service area is about 25,000 gallons per day.

The chemical quality of ground water throughout the county is fairly good, being soft to moderately hard and low in dissolved solids. The water in some locations is slightly acidic and has an excessive iron content.

Brunswick County is adjacent to rapidly urbanizing Dinwiddie County, a portion of the Petersburg-Colonial Heights Standard Metropolitan Statistical Area. Many people in this watershed have off-farm employment in commerce and industry, due to this strong urban influence within a one hour drive. Economic growth and development have been retarded in recent years because of the lack of an adequate water supply and distribution system. Orderly development of the county will require the addition of surface storage and expansion of existing water treatment and distribution systems. The consultants retained by the county recommend development of the surface water resources of Great Creek to include municipal storage adequate to supply the anticipated needs of an integrated county-wide system.

The following table shows the future water needs for the anticipated population to be served.

DOMESTIC WATER REQUIREMENTS FOR THE
LAWRENCEVILLE-ALBERTA SERVICE AREA

Year	Population Served	Water Needs (m.g.d.)
1975	3,000	0.32
1980	3,200	0.37
1985	3,700	0.44
1990	4,200	0.51
1995	4,700	0.60
2000	5,300	0.68

Based on the consultants report, the year 2000 water supply requirements for north central Brunswick County is projected to be between 2.8 and 4.2 million gallons per day. These requirements are further broken down as follows:

Residential and Minor Commercial	0.6 to 0.8 m.g.d.
Industrial	1.4 to 2.2 m.g.d.
Agriculture	0.8 to 1.2 m.g.d.

Therefore, based on the medium population and economic growth projections, the anticipated water demand rate to meet these requirements is 3.5 million gallons per day.

RECREATION AND PLANT AND ANIMAL PROBLEMS

The principal problem with respect to recreation in Great Creek watershed is the complete lack of outdoor recreation areas or facilities open to the public. All hunting lands and fishing waters are privately owned and most of the land is posted.

Contact with local residents indicates that stream fishing in Great Creek is limited. The fishery is of low quality, both in fish populations and habitat potential. The stream is small in size, with low flows during the dry season, and few fish reach fishable size. The principal species include suckers, chubs, minnows, darters, shiners, madtoms, bullheads, pickerel, and various sunfish.

Damage to fish and wildlife resources occurred during tropical storm Agnes and the October 1972 storm. Pools silted in and Great Creek carried a very heavy sediment load for three days after each storm. The stream stayed muddy for several weeks afterwards, reducing food and micro-organisms needed by fish and aquatic animals.

In the Virginia Outdoors Plan, 1974, a series of calculations were made to show the per capita rates of public participation in various kinds of recreational activities and the indicated demand for each kind of facility. These calculations were then projected to the years 1980, 1990, 2000, and 2020, and are presented in table on page II-54.

Recreation needs as determined from this study include access to and facilities for hunting, fishing, picnicking, camping, and beach use.

Statewide Demand: Units/Facilities 1/

Activity	Unit	1972	1980	1990	2000	2020
Fishing	acre	1,348,000	1,506,000	1,768,000	2,056,000	2,694,000
	mile	84,250	94,120	110,500	128,500	168,370
Swimming Pool	sq. ft.	5,150,000	6,418,750	8,537,500	11,043,750	17,393,750
Beach Use	acre	1,180	1,460	1,950	2,520	3,970
Boating	acre	349,000	438,000	584,000	759,000	1,197,000
Canoeing	mile	610	750	1,030	1,300	2,080
Surfing	linear ft.	15,000	19,170	25,830	34,170	55,830
Off-road Recreation Vehicle Use	mile	120	150	210	270	450
Hunting Inland	acre	1,583,330	1,716,670	1,958,330	2,200,000	2,683,330
Hunting Waterfowl	acre	133,330	150,000	158,330	183,330	233,330
Picnicking	acre	11,340	13,210	16,410	20,070	28,800
	table	79,380	92,470	114,870	140,490	201,600
Camping/Family	acre	6,100	7,800	10,700	14,100	22,850
	site	30,500	39,000	53,500	70,500	114,250
Camping/Group	acre	900	1,100	1,600	2,000	3,200
Golfing	first hole	290	360	480	620	970
Tennis	court	3,870	4,810	6,440	8,340	13,120
Outdoor Games	field	17,520	21,770	29,080	37,530	59,120
Bicycling	mile	3,570	4,560	6,260	8,240	13,330
Hiking/Walking	mile	16,530	20,930	28,230	36,970	59,030
Horseback Riding	mile	10,600	12,500	15,700	19,400	28,300
Ice Skating	rink	11	14	19	26	42
Archery	range	720	890	1,170	1,500	2,390
Firearms Shooting	range	770	950	1,270	1,650	2,580
Snow Skiing	acre	60	70	90	130	220
Playground Use	playground	600	740	1,000	1,280	2,020
Outdoor Dramas/Concerts	seat	48,000	60,000	79,000	102,000	158,000

Source: Spindletop Research, Inc., 1972.

1/ Virginia Outdoors Plan, 1974. Table 7, page 39.

The Virginia Outdoors Plan, 1974, shows fishing demands by regions. Brunswick County is in Region 11, Southern Piedmont, which includes the counties of Brunswick, Mecklenburg, Halifax, Pittsylvania, Henry, Patrick, and Franklin, and the independent cities enclosed by these counties. In 1972 in Region 11 there was 31,458 acres available for fishing. The following table shows projected fishing demand and need.

FRESHWATER FISHING - REGION 11

Year	Fishing Acres Demand	Fishing Acres Need
1972	80,300	48,842
1980	82,670	51,000
2000	94,550	63,000
2020	108,520	77,000

The 212-acre reservoir will supply a portion of the future recreation needs in Region 11.

From 1970 U.S. Census figures, approximately 104,105 people live within one hour's travel time of Great Creek. Fishing license sales from this area indicate that one out of every nine residents fishes. It is estimated that an average fisherman fishes 21 days per year. Therefore, licensed fishermen within one hour's travel time from Great Creek spend about 250,000 man-days fishing per year. In just 10 years, the number of licensed fishermen is expected to increase by more than half, and in 30 years it will almost triple.

Sites 76, 78, and 83 in the North River watershed in Augusta and Rockingham Counties and Site 11 on Mountain Run watershed in Culpeper County have been built on public lands and are managed in a manner generally similar to plans now being considered for Great Creek. The use information of these sites is for the years 1968, 1969, and 1970 and is considered reasonable as a basis for estimating the user-days for Great Creek. Information on the user-days for the sites in North River was supplied by the U.S. Forest Service from their records, and are included in the following tabulation:

Site	User-Days	Surface Acres Permanent Pool	User-Days Per Surface Acre
Mountain Run 11	3,500	75.0	46.7
North River 76	11,800	55.0	214.6
North River 78	1,100	10.4	105.8
North River 83	1,200	5.5	218.2
			120.6 Average

Wildlife habitat is good in the Great Creek watershed. Farming and logging operations have created openings in the forest land which generally are beneficial to most forms of wildlife. Land in homes, buildings, roads, etc. totals 328 acres. This will gradually reduce wildlife habitat as development continues, but at present does not present any real problem as it represents only 1.1 percent of the watershed area.

WATER QUALITY PROBLEMS

Samples from the vicinity of the damsite, the raw water intake, and the Lawrenceville water supply were taken and analyzed. Water quality was good as shown in the data in appendix G. No industrial or point sources of pollution were found in the watershed. The stream above site 6A will be continually monitored and will meet the Virginia State Health Department requirements prior to and during use for public water supply.

ECONOMIC AND SOCIAL PROBLEMS

The 1969 Census of Agriculture indicates that about one-third of the farms in Brunswick and Lunenburg Counties which provided substantially all of the operators' income had gross sales of less than $5,000. In addition, about 30 percent of all farms were classified as "part-time" or "part-retirement" farms with gross sales of less than $3,000. Farm operations in the watershed are generally typical of those for the area, which would indicate that about 115 of the 179 farm families in the watershed have annual incomes of less than $5,000, even after allowing for some off-farm income. There are five farms in the watershed which use 1-1/2 or more man-years of hired labor.

The 1970 Census indicates this watershed had an average per capita income of $1,830 or about 61 percent of the state average of $3,012. It indicates that this watershed had a mean income per family of $6,970 or about 66 percent of the state average of $10,568. The Census data also indicates that approximately 44 percent of the homes lacked direct access to complete bathroom facilities and 38

percent lacked direct access to complete kitchen plumbing facilities. For the State of Virginia, 11.4 percent of the families lacked direct access to complete bathroom facilities and 8.7 percent of the homes lacked complete kitchen plumbing facilities.

These facts emphasize the serious need for development of all local resources to aid in improving family income and living standards. Development of the land and water resources in the area will encourage economic growth and rural area development and will result in improved income and family life styles and a better overall place in which to live.

RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

This watershed plan has been developed in accordance with existing federal, state, and local land use plans, policies, and controls. Particular attention has been given to the Federal Water Pollution Control Act Amendments of 1972. One of the major objectives of the plan is to reduce erosion on the watershed, thereby reducing stream pollution from this source. The project will also aid in reducing sedimentation in the Emporia reservoir and downstream in the navigable channels of the Chowan River, the Inter-Coastal Waterway, and Albemarle Sound.

The Southside Planning District Commission, which includes Brunswick County, and the Piedmont Planning District Commission, which includes Lunenburg County, are in the process of developing long-range resource plans for this area. Control of floodwater and sediment, along with an adequate municipal and industrial water supply are major concerns in the region's resource and development plans. Surface storage in the Great Creek watershed is an integral component of a county-wide water supply plan now being developed for Brunswick County. Other features of the watershed plan will serve as resource planning tools for the Planning District Commissions, county, and town planning commissions for long-range planning, zoning, and development of the area's resources.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT

Approximately 8,438 acres of watershed land will be affected by the application of accelerated conservation land treatment measures. Both vegetative and structural types of land treatment measures will effectively reduce runoff, conserve soil moisture, and prevent excessive loss of topsoil on 179 farms. Studies conducted by the Agricultural Research Service 1/, indicate reductions in runoff from 28 to 56 percent depending on the practices installed. The Extension Division of Virginia Polytechnic Institute and State University 2/ conducted studies that show no tillage planting can result in 80 to 90 percent less runoff. See Appendix D for a description of individual land treatment measures.

Land treatment will help to restore and maintain soil productivity by adding or holding plant nutrients. It will reduce soil losses on cropland and pastureland to tolerable limits so a suitable soil profile will be available in future years to grow plants for a sustained and indefinite period. Soil losses on woodland will be reduced to less than 2 tons per acre per year.

Where appropriate, land use changes will be made. Degradation of surface waters by agricultural pollutants attached to soil particles will be reduced by reducing erosion.

Conservation land treatment will be installed on 800 acres of cropland, 625 acres of pastureland, 33 acres of other open land, and 6,980 acres of woodland. Land treatment measures include wildlife habitat management on 15 acres. This is accelerated land treatment and in addition to the going program.

A resource management system is a group of interrelated conservation practices or land treatment measures and management techniques applied to a given resource such as cropland, woodland or pastureland for specified functions or uses such as: timber, forage, hay, and crop production; improvement of fish and wildlife habitat; improvement of water quality; and improvement of esthetics in the watershed. Many of the measures will enable landowners to more fully utilize sound resource management systems to increase efficiency of production. Planned land treatment measures are estimated to reduce the gross erosion rate from 4.2 to 3.4 tons per acre per year, and the gross erosion on cropland from 16.3 to 12.1 tons per acre per year.

1/ Agricultural Research Service, Technical Bulletin 1281, USDA, Runoff and Erosion Control Studies on Cecil Soil in the Southern Piedmont.

2/ Lillard, J. H., Professor and Tillage Research Leader and Smith, Easley S., Extension Specialist, Farm Machinery Department of Agricultural Engineering, VPI & SU, No-Tillage Machinery and Seedbed Requirements, Publication 419, Cooperative Extension Service, March 1971.

FUTURE LAND USE ANTICIPATED (1980)
-with and without planned structure-

Class	LAND USE								TOTAL AREA ACRES
	CROPLAND Acres		PASTURELAND Acres		FOREST LAND Acres		OTHER Acres		
	with	without	with	without	with	without	with	without	
I	73	-	-	20	-	50	-	3	73
II	2,323	2,087	1,382	1,456	7,291	7,453	157	157	11,153
III	806	956	760	501	5,036	5,145	130	130	6,732
IV	366	416	364	314	5,195	5,195	43	43	5,968
V	30	170	220	87	684	677	0	0	934
VI	19	115	304	212	3,843	3,839	0	0	4,166
VII	47	147	92	324	560	228	29	29	728
VIII	0	0	0	0	0	0	0	0	0
Totals	3,664	3,891	3,122	2,914	22,609	22,587	359	362	29,754

Land treatment measures will reduce the amount of sediment leaving the watershed by about 3,277 tons annually. The sediment from Great Creek contributes to the total load in Meherrin River. Therefore, reducing the production of sediment will lessen downstream damages to municipal and industrial water supplies, fish habitat, recreation, and esthetics. Accelerated soil surveys and other resource inventories will provide basic information needed by landowners in planning land use changes and improved resource management systems.

LAND USE IN THE BENEFITED AREA
WITH AND WITHOUT THE PROPOSED PROJECT

	Acres in Use	
Land Use	Without Project	With Project
Corn-Grain	17	56
Silage	47	68
Hay	44	48
Pasture	84	106
Forest and Idle	426	340
Other	146	146

STRUCTURAL MEASURES

Installation of the proposed structural measures will require that the land use be either changed or modified on a total of 642 acres. In the area to be inundated by the sediment and water supply pool are 32 acres of cropland, 163 acres of forest, and 17 acres of other land. The flood detention pool, which will only be flooded occasionally, contains 7 acres of cropland, 365 acres of forest, and 34 acres of other land. The construction area will occupy what is now 4 acres of pastureland and 20 acres of forest land. Installation of the proposed project measures will not affect any wetlands 1/ and will have minimal effect on wildlife diversity and distribution. During prolonged drought periods up to 76 acres may be exposed due to drawdown for water supply.

The 950 acre-feet of high quality municipal and industrial water storage will provide for expansion of the three existing public systems to a county-wide system. It will also relieve dependency on individual water systems. The net demand rate that can be supplied from Great Creek with this amount of storage is 3.5 million gallons per day. This will provide for economic growth and development of the county, thus reducing the migration of families from rural to urban areas by providing local employment opportunities.

1/ Shaw, S. P., and Fredine, C. G., 1956. Wetlands of the United States. United States Department of the Interior, Fish and Wildlife Service Circular 39.

Installation of dam and land treatment measures will reduce downstream floodwater and sediment damages by approximately 71 percent. The 12-inch slide gate located 5 feet above the base of the riser in combination with the water supply gates will serve the function of water flow management. The State Water Control Board and the Sponsors will develop guidelines for operation of the release gates. Additional storage capacity has been provided in order to maintain a release rate during drought periods equal to the 10-year, 7-day low flow.

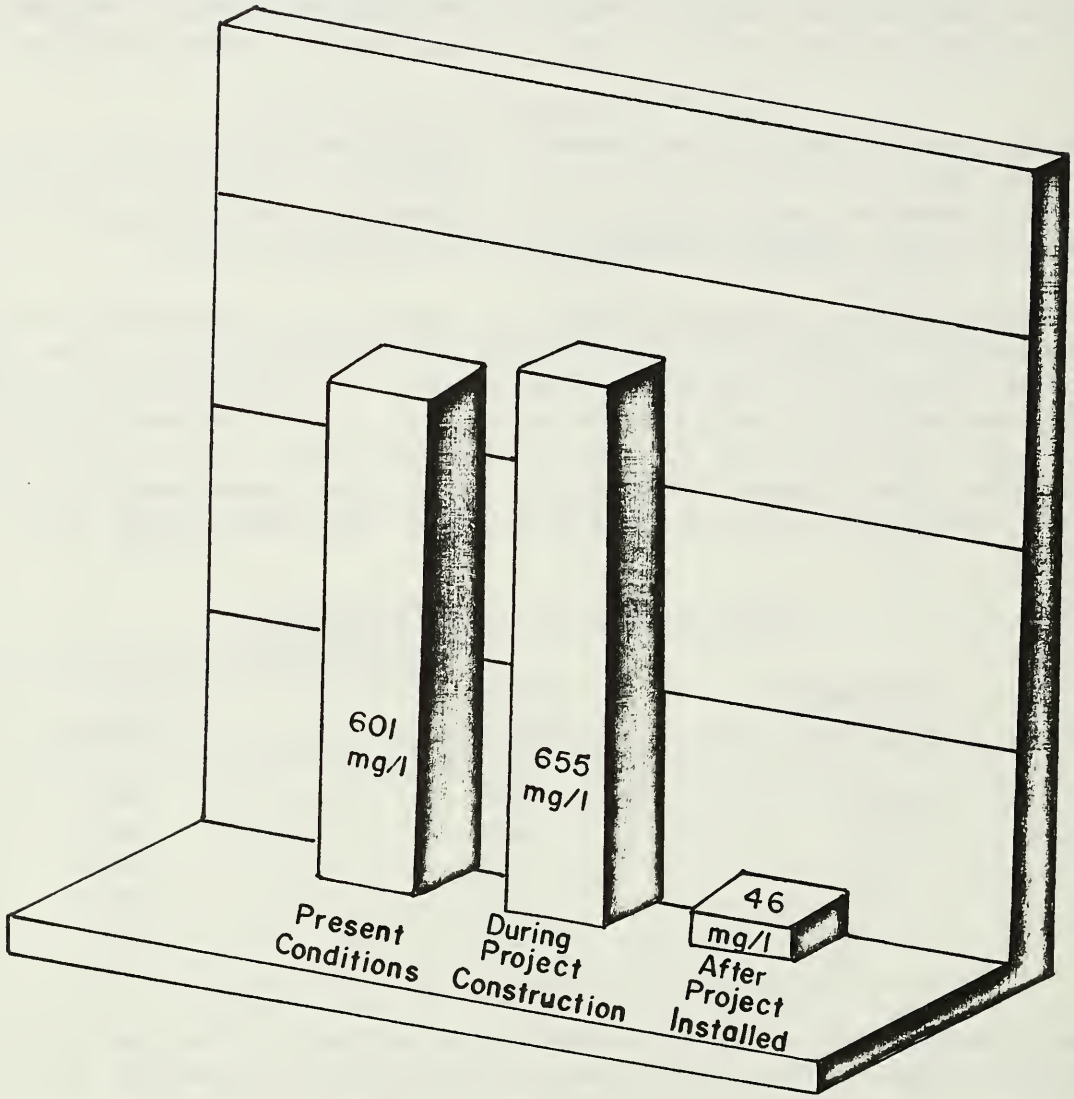
During construction, an estimated 40 man-years of employment will be filled from the local labor market. Operation and maintenance of project measures and provision for incidental recreation use of the reservoir will provide an estimated five permanent jobs.

Protection of the flood plain will allow the farm operators and other landowners to manage their operations more efficiently on about 300 of the 764 acres of protected flood plain. A total of 32 landowners will receive flood prevention benefits as a result of the project. The area flooded by the 100-year frequency storm will be reduced by 141 acres, the 10-year storm by 131 acres, the 5-year storm by 151 acres, the 2-year storm by 164 acres, and the 1-year storm by 192 acres.

ACRES FLOODED BY STORM FREQUENCY

Frequency in years	Without Project	With Project
100	764	623
10	619	488
5	572	421
2	501	337
1	397	205

The structure will trap 916 acre-feet of sediment. The amount of sediment leaving the Great Creek watershed will be reduced by 15,433 tons annually. Reduction in the amount of sediment moving into channels and reservoirs downstream will not only improve the quality of water for human consumption, but will also improve conditions for fish and wildlife. The project will result in savings estimated at $18,630 annually in costs of sediment removal and disposal from water supply reservoirs and navigable waters alone.



ESTIMATED SEDIMENT CONCENTRATION

AT GREAT CREEK SITE NO. 6A

Fig. 12

Turbidity is expected to increase at times during construction. The average annual sediment concentration at the proposed damsite under present conditions is estimated to be 601 mg/l. The concentration is then expected to drop to 46 mg/l after construction is completed and land treatment measures are installed 1/. See Figure 12, page 63.

A new fishery, having a minimum of 136 acres and a maximum of 212 acres of warm-water fish habitat will be created. This pool area will have 8.1 miles of shoreline, while inundating 4.8 miles of perennial and 2.1 miles of intermittent streams. The streams affected contain low populations of fish and are subject to practically no fishing pressure. The new lake will be stocked with largemouth bass, bluegill and redear sunfish, and channel catfish. Recreational opportunities for lake fishing are expected to result in 12,000 user-days annually. There will be an increase in vehicular traffic, noise, fire hazard, solid waste, and litter as a consequence of increased human activity because of recreation.

An estimated winter breeding population of 5 deer, 1 wild turkey, 16 gray squirrels, and an unknown number of cottontail rabbits and other small animals will be displaced from the 212-acre pool area, but not necessarily from the watershed. Some species of fish such as lamprey, bull chub, and various darters and shiners will decrease in the reservoir, while other species such as largemouth bass, warmouth, pickerel, sunfish, and catfish will increase in population (for a complete list, see fish species under appendix E). Inundation of the flood pool will temporarily displace terrestrial species, but at the same time protect these same species in the flood plain below the reservoir. There are no known threatened or endangered plants or animal species within the watershed.

Construction of the multiple-purpose reservoir will require the clearing of 163 acres of forest land in and adjacent to the pool area, and the clearing and grubbing of another 20 acres in the construction area. This forest land consists of stands of cut-over hardwood and brush. The hardwoods provide habitat for many animals including squirrels and songbirds, and the cut-over areas provide some habitat for deer, rabbits, quail, and other small non-game animals. The 406 acres in the flood pool, which is about 90 percent wooded, will only be flooded occasionally. While this will disrupt wildlife habitat patterns during flooding, it will also protect this area of wildlife habitat from future development.

One secondary state highway (No. 763) will be slightly affected by installation of the dam. The road will only be flooded by storms in excess of the 100-year, 24-hour duration storm; however, about 400 feet of the road would be flooded to a maximum depth of

1/ These sediment calculations are based on data computed with annual loads.

about 8 feet at the crest elevation of the emergency spillway. This is a dirt road, used infrequently as a connecting link between U.S. Highway No. 1 and State Highway No. 46. It also serves as an access road for three houses and for a logging operation. Use of the road does not decrease the travel time between major population centers. Section 33.1-223.2 of the Code of Virginia allows this road to remain in use. Permission will be obtained from the Department of Highways and Transportation to close it temporarily during flooding. Brunswick County will be responsible for the posting of warning signs and for closing off the road during extremely high flood flows. A stream gage at the same crossing will require relocation.

There are no known sites of historical or archeological importance that would be affected by the installation of the structural measures.

ECONOMIC AND SOCIAL

Development of an overall land and water resources plan will enhance the economy of the watershed and surrounding area, improve the scenic values, and aid in improving local living standards.

Primary objectives of this project, to provide a minimum of 2-year frequency protection to at least 50 percent of the 764 acres of flood plain in the benefited area, and protection of existing highways from significant damage from the 100-year frequency storm, will be realized. With the project installed, damage to existing urban commercial properties at Lawrenceville by the 100-year frequency storm will be limited to inundation of four to six access drives and parking lots one foot or less. This protection will make possible land use adjustments which will allow a higher level of management of the agricultural land. Use of practices such as improved crop varieties and more timely planting, cultivating, and harvesting of crops will improve both farm income potential and the quality and quantity of forage and grain crops and food available to meet local and regional needs. Harvesting, processing, and distribution of the increased production of products will improve both farm and off-farm employment opportunities for an undetermined number of presently underemployed workers.

Expansion of the public water system in this area, as an integral part of a planned county-wide water system, will improve a utility which has limited economic growth and the improvement of living conditions for decades. Homes with complete kitchen plumbing facilities are expected to increase from 62 percent in 1970 to an estimated 90 percent by 2020; homes with flush toilets will increase from 56 percent in 1970 to between 85 and 90 percent in the next 20 years.

Unemployment has averaged 4.2 to 4.8 percent of the work force since 1960. However, with per capita income 40 to 45 percent below the state average, significant underemployment of human resources is indicated.

Development of this project will provide conditions which will encourage an increase in local commercial and industrial operations. This will increase employment opportunities and income levels, as well as regional and national production and income.

A committee familiar with local conditions determined that installation of this project would maintain the local tax base by protecting flood plain improvements and improving land values. Their estimate is that flood plain land values will increase from $100 to $300 to about $500 to $600 per acre where a higher level of agricultural use is made possible.

Traffic interruptions from flooded roads downstream will be virtually eliminated for the 1,690 people now living in the watershed, and for the many travelers who use the roads daily.

Benefits from this project will extend beyond the watershed boundary. Damages and damage reduction evaluations were made on the flood plain of Great Creek from Roses Creek to the Meherrin River. Damages will also be reduced on flood plain lands on the Meherrin River; however, no attempt was made to evaluate monetary benefits from this project in these areas.

FAVORABLE ENVIRONMENTAL EFFECTS

a. Reduce floodwater and sediment damages by approximately 68 percent and provide 100-year frequency flood protection to existing commercial buildings in Lawrenceville

b. Reduce sediment leaving the watershed by about 15,433 tons annually

c. Reduce erosion, retard runoff, improve wildlife habitat, and enhance the esthetic values of the watershed by accelerating installation of land treatment measures on 8,438 acres.

d. Provide an estimated 12,000 annual recreation visits by construction of a 212-acre lake available for public fishing

e. Create 212 acres of warm water fishing and waterfowl habitat

f. Create approximately 40 man-years of employment during construction and 5 permanent jobs

g. Increase farm income by allowing more efficient and effective use of about 300 acres of flood plain land

h. Provide a high-quality water source

i. Reduce downstream sediment damage to the Emporia Dam and the Meherrin River

j. Improve living conditions in the area by controlling floodwaters

k. Improve wildlife habitat on 15 acres

l. Reduce average gross erosion rates from 4.2 tons per acre per year to 3.4 tons per acre per year, and the gross erosion on cropland from 16.3 to 12.1 tons per acre per year

m. Provide water storage allowance for flow management

ADVERSE ENVIRONMENTAL EFFECTS

a. Inundate approximately 4.8 miles of perennial and 2.1 miles of intermittent stream at the permanent pool elevation

b. Inundate or restrict use of 642 acres of land presently in forest land, cropland, and pastureland

c. Increase turbidity at times during construction period

d. Increase vehicular traffic, noise, fire hazard, solid waste and litter as a consequence of increased human activity

e. Reduce terrestrial wildlife habitat by 212 acres

f. Expose up to 76 acres from drawdown for water supply during prolonged drought

g. Convert 86 acres of forest and idle land to crop and pasture.

ALTERNATIVES

ACCELERATED CONSERVATION LAND TREATMENT ONLY

Under this alternative technical assistance would be provided to keep conservation and forest land management plans up-to-date, to develop new plans as land ownership or land use changes, to maintain existing adequate cover, and to maintain installed land treatment measures. It would involve applying the needed conservation measures identified and described in the Land Treatment Measures under Planned Project. The total cost of this alternative would be $222,130, including the cost of maintaining the going conservation program, during the installation period.

The effectiveness of this alternative in reducing soil erosion and sedimentation should be essentially the same as for land treatment measures in the proposed project; i.e. a 19 percent reduction at the end of the project installation period. Improved water infiltration into the soil due to land treatment measures would not have a noticeable effect on a storm of a 10-year or greater frequency. Floodwater damage reduction is estimated to be 7 percent.

This alternative would essentially meet the sponsors' objectives related to land treatment, but flood damages would continue to occur to agricultural interests, businesses, roads, bridges, and other flood plain improvements. The water supply objectives of the sponsors would not be met. There would be a net increase in cultivated crops on upland areas with this alternative. Growth and economic development of the area could not be accomplished at the rate desired by the sponsors due to inadequate water supply.

Another effect of this alternative would be that recreation needs of the area would remain unsatisfied. The facilities for an estimated 12,000 recreation visits annually would not be provided.

The 236 acres of land involved in the structure and water area, as proposed in the selected plan, would remain as cropland, pastureland, and forest land with incidental wildlife uses. Wildlife food and cover would be furnished from field borders, scattered areas or wildlife plantings, and residual grains remaining after harvest. Almost 4.8 miles of perennial and 2.1 miles of intermittent stream would be retained. The temporary increase in turbidity during construction of the dam would not occur.

NONSTRUCTURAL ALTERNATIVES

Accelerated Land Treatment with Acquisition of Flood Plain Land and Flood Plain Properties - This alternative would include the benefits and impacts of the accelerated land treatment alternative. Acquisition of the 100-year flood plain and flood plain properties would include the purchase of approximately 500 acres, and 10

commercial and industrial properties which are subject to flooding. These purchases would cost about $815,000.

The removal of commercial and agricultural operations from the flood plain would eliminate the present physical damages to these interests. Damages to roads, bridges, and utilities would continue. Farm operating costs would increase, jeopardizing the farmer's competitive position, and increasing the dependence on off-farm income. In some instances, purchase of the flood plain would leave an inefficient unit which would not permit the continuation of the farm or business at the existing location. This would require the purchase of the entire property and relocation of the operations and families involved to other suitable properties, as required by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. These actions would erode the local property tax base and cause social problems which would adversely affect the individuals concerned and the local economy.

Condemnation of at least some of the properties would be necessary which would also adversely affect the people and, in turn, the economy.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The facilities for an estimated 12,000 recreation visits annually would not be provided. This alternative would essentially meet the sponsors' objectives for land treatment; however, an additional 1,000 acres of upland converted from pastureland and forest land to cropland would require more intensive land treatment to provide adequate conservation measures for control of erosion and sedimentation problems.

Fish and wildlife habitat conditions would be similar to those described in the Accelerated Conservation Land Treatment Only alternative, with some cover lost on the upland and gained in the acquired area.

The flood prevention and sediment reduction objectives of the sponsors would not be met. No provision would be made for the municipal and industrial water needs.

Flood damages would continue to occur to roads and bridges. The impacts and effects associated with the installation and operation of the multiple-purpose structure in the selected plan would not occur.

STRUCTURAL ALTERNATIVES

Accelerated Land Treatment and Channel Work - This alternative consists of accelerated land treatment and channel work. The

land treatment phase, its composition, its costs, and its effects are described in the Accelerated Land Treatment Only alternative. The channel work would consist of 5.2 miles of channel enlargement and the protection of that channel from erosion by rock riprap. The excavated spoil would be spread through open areas and would be uniformly placed and seeded through wooded areas. A 31-foot strip along either side, including the berm and part of the spoil through wooded areas, would be seeded to adapted grasses and shrubs to provide ground cover, minimize erosion, and provide food and cover for wildlife. These areas would also provide access travelways for inspection and maintenance purposes. The bridge span of old Highway No. 58 would need to be increased by 20 feet, and Highway No. 713 bridge would require replacement.

The construction of the new channel would require approximately 200 acres of land including the existing channel and flood plain land now in crops, pasture, forest, and fringe areas. The 200 acres needed for landrights would include approximately 39 acres for the two access travelways.

The channel would be designed to provide the same level of protection as the selected project. The estimated cost of this alternative would be approximately $5,734,000.

This alternative would reduce flooding to a level that would allow agricultural land use and management practices comparable to those for the planned project on the area not required for channel enlargement and the maintenance right-of-way. Channel construction would require 18 acres of land now occupied by the channel, 47 acres in cropland and pastureland, and 152 acres in forest land and other uses. The recreational needs of the area would remain unsatisfied because the facilities for an estimated 12,000 recreation visits annually would not be provided. Sediment produced by the construction would adversely affect aquatic life and water quality during the construction period and for about 3 years after construction at a decreasing rate. Water supply objectives of the sponsors could not be met with this alternative. This alternative would not require as much land; consequently, some of the unfavorable impacts associated with the planned project would be avoided.

Accelerated Land Treatment and Diking - The structural measures portion of this alternative would consist of a dike and floodway along either side of the existing channel between the NF&D R.R. and Highway No. 713, a distance of approximately 1.6 miles. The floodway width between the two dikes would be proportioned in accordance with the principle of equal reduction in conveyance on either side of the flood plain, with a two-foot increase in depth for the 100-year design flow. Two pumping stations, one on either side just above the Highway No. 58 by-pass, would be needed to discharge runoff from behind the dikes during periods of

high flow. Pipe inlets equipped with tide gates would be installed to discharge all runoff amounts below the 2-year frequency, and up to the 100-year frequency during periods of low flow in the main channel.

The average width of the floodway, including the channel, between the two dikes would be about 600 feet. This would be an advantage from the standpoint of structural stability, but would preempt the use of this land (approximately 115 acres) for other uses. Both the channel and flood plain in this area would require maintenance to preserve the present hydraulic capacity, thereby increasing the overall expense for this purpose. Pumping equipment, as well as the pipe inlets would require replacement during the 100-year project life.

The dikes, collection ditches, and access travelways would occupy about 12 acres of land now being used for crops and pasture, and 34 acres in forest land and miscellaneous uses. Construction of the dikes would require a borrow area of about 20 acres. This borrow area would be outside of the present flood plain, and would require clearing and grubbing.

The dikes and pumping stations would provide about the same level of protection through the urban area of Lawrenceville as the selected project; however, only the area behind the dikes would be benefited. The water level would be increased a maximum of two feet upstream from the NF&D R.R., thereby increasing the flood hazard somewhat in that area. The estimated cost of this alternative would be $1,175,000.

Accelerated Land Treatment and Single-Purpose Water Supply Structure - This alternative would include the installation of the accelerated land treatment previously described, and separate development of a water supply system. A structure could be developed on Great Creek at the location of damsite 6A to provide the projected demand rate of 3.5 million gallons per day. This would require the purchase of an estimated 236 acres of land. About 4.8 miles of perennial stream would be inundated and a reservoir of 212 acres would be created. The water would be delivered to the point of need by gravity flow. The estimated cost of a single-purpose structure would be approximately the same as the cost of the multiple-purpose structure in the proposed project.

This alternative would provide the same reduction in sheet erosion on the uplands as the planned project. A water supply structure on Great Creek would trap sediment and reduce downstream sediment damages about the same as the planned project. The water supply objectives of the sponsors could be met by this alternative. The facilities for an estimated 12,000 recreation visits annually could be provided.

The flood prevention objectives of the sponsors would not be met nor the impacts and effects of increased turbidity associated with the construction and operation of the water supply reservoir be avoided by a single-purpose structure.

Accelerated Land Treatment and the Meherrin River as the Water Source - This alternative would include the installation of the accelerated land treatment previously described, and separate development of a water supply system.

The Meherrin River could be used as the primary source of water instead of Great Creek. There is an existing 8-inch pipeline from the Meherrin River to the Lawrenceville treatment plant and this facility is used as a secondary source of water.

In order to use the Meherrin River as a primary source of raw water, a concrete intake structure would have to be installed. Additionally, a settling basin should be constructed at the intake location to reduce transfer of suspended solids and thereby reduce the buildup inside the transfer pipeline.

Construction of an intake structure and a settling basin, installation of a 12-inch pipeline parallel to the existing line and installation of a 175 HP. transfer pump would comprise the major construction cost elements of this method. The estimated installation cost of the Meherrin source is $388,380. To this cost would have to be added an estimated $49,900 annual operating cost. Treatment costs of water from the Meherrin River are considered about equal to those of Great Creek.

This alternative would provide the same reduction in sheet erosion on the uplands as the planned project. With the Meherrin River as the source of raw water, the effectiveness of this alternative in reducing flood water and sediment damages is described in the Accelerated Conservation Land Treatment Only alternative.

An effect of the Meherrin River alternative would be that the recreational need of the area would remain unsatisfied. The facilities for an estimated 12,000 recreation visits annually would not be provided.

The Meherrin River alternative would satisfy the water supply objectives and avoid the adverse effects associated with the construction of a single or multi-purpose structure.

NO PROJECT

The alternative of no project was considered. This would mean that the structure would not be built and the needed land treatment would not be installed as rapidly. The sponsors' existing program of land treatment installation would continue at the present rate at a total cost of $383,900 over a period of about 40 years.

The effectiveness of this alternative in reducing soil erosion would be essentially the same as the Accelerated Conservation Land Treatment Only alternative; i.e., a 19 percent reduction, but over the long-term. The landowners would have to delay installation of the land treatment measures until the staff available to the sponsors could provide them with adequate technical assistance. The time involved in this would be at least 40 years, whereas the proposed installation period would be 5 years.

This alternative would result in further deterioration of resources. Damage to cropland, pastureland, and flood plain would continue at a decreasing rate as land treatment measures are installed under the going program. Net benefits foregone would amount to $31,485 annually.

Stream flow characteristics would continue to be subject to weather fluctuations, and debris from large storms would continue to cause channel blockage. Sediment would continue to damage flood plains and roads and bridges. Downstream benefits resulting from trapped sediment would not be realized. Expansion of the area would not be accomplished at the desired rate because of the lack of a municipal and industrial water supply.

An effect of this alternative would be that the recreational needs of the area would remain unsatisfied. The sponsors' objectives would not be met because land treatment would continue at the present rate, flood damages would continue, and municipal and industrial water would not be available.

This alternative would avoid the loss of approximately 236 acres of cropland, pastureland, forest land, and wildlife areas that would be covered by water resulting from the structure of the proposed project. Four and eight tenths miles of perennial stream channel and 2.1 miles of intermittent stream would be retained. The increased turbidity associated with the construction activities would be avoided.

SHORT-TERM VS LONG-TERM USE OF RESOURCES

Even with an increase in industry in and around Lawrenceville, agriculture is expected to remain the dominant segment of the economy in the Great Creek watershed for the foreseeable future. The future land use will show a gradual shift from the marginal cropland into pastureland and forage production for livestock. The remaining, more productive cropland will be more intensively farmed to meet the demand for field crops such as wheat, corn, and soybeans.

The projected land use in the watershed is compatible with the projected resource needs anticipated by the Piedmont Planning District Commission and the Brunswick County Planning Commission. With the proposed land treatment measures and flood prevention structure, the needs of sustained or increased productivity will be provided.

The structural phase of the project will not correct short-term environmental problems. In fact, pollution from sediment, dust, noise, and burning will occur during the installation period. However, the factors which cause pollution will be minimized through planning and control of construction operations. This short-term pollution will cease after construction is completed.

The project will reduce options for long-term land use only on areas incorporated into the dam, spillway, and permanent and flood pool. It is compatible with the long-term land use trends of the adjacent land resources and will help to build more stability into the economic system. Ground water resources and air resources will not be impaired.

This watershed plan provides a level of protection consistent with the needs and objectives of the present and anticipated uses of the flood plain. It will allow the use of improved management practices on 459 acres of flood plain in the watershed which will result in increased agricultural production. Incidental recreation will also be provided.

Proper installation of needed land treatment measures on the whole watershed will help increase production and preserve the land resources for future uses. With the protection given to roads and bridges, the transportation of goods and services through the watershed will be maintained at least through a 100-year storm. Some protection will also be given to the Norfolk Franklin and Danville Railroad fill. Sediment entering the Meherrin River from Great Creek will be reduced by approximately 15,433 tons per year. Nine hundred and fifty acre-feet of water will be available for municipal and industrial use.

The completed project is expected to be effective in conserving land and water resources long after its designed life. Future usefulness of structural measures for protecting damage in reaches D and E in in the watershed and reach F below the watershed will continue beyond the economic life of the sediment pool. The structure will become slightly less efficient as sediment accumulates in that space reserved for municipal and industrial water storage. Flood protection will not decrease significantly because the rate of sediment accumulation will be low and the combined municipal and industrial water storage and flood storage is high.

However, periodic removal of sediment from the sediment pool could restore the trap efficiency of the structure thereby allowing it to continue to function indefinitely as a sediment trap, water supply, and flood prevention structure. If this accumulated sediment is not removed, the municipal water storage available will decrease as sediment is deposited in the area allotted for municipal and industrial water supply.

At present, there is one completed project, a flood control and drainage measure at Hobbsville-Sunbury on Bennett and Catherine Creeks, which are tributaries to the Chowan River. The Great Creek watershed is in the Chowan River drainage basin and is included in the South Atlantic Gulf Region (03), Roanoke Basin Subregion (0301). It solves problems within the watershed area and is not dependent upon any other P.L. 566 project for achieving benefits.

The cumulative environmental effects within the watershed will include the improvement of water quality and the quality of wildlife habitat. These amenities are due to the effect of land treatment and to the reduction of stream turbidity.

Secondary impacts resulting from these developments will be incidental sport fishery and associated recreational opportunities created in connection with the reservoir. This will entail outlays for capital improvements such as access roads, parking areas, boat ramps, and restroom facilities at selected locations. Since a new fishery is being created, a slight increase in sales of fishing licenses will occur, along with associated vehicular services, restaurant, small boat, fishing pole, bait, and other equipment sales.

An increase in vehicular traffic during the fishing season can be expected on the secondary roads leading to the reservoir. Other closely related recreation pursuits would include canoeing, picnicking, photography, hiking, birdwatching, and nature study.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The land committed to the construction of the structure and emergency spillway and the sediment and water supply pools is about 236 acres. As a result of flood-producing storms, there may be as much as 406 more acres inundated within the flood detention pool. Use of this land will be restricted since it is also committed to the project. Therefore, the total acreage committed to this project is about 642 acres. Approximately 4.8 miles of perennial and 2.1 miles of intermittent stream will be inundated by the structure, sediment pool, and water supply pool. Three additional miles will be inundated when the flood detention pool fills. The area that will be committed to each land use is given in the following table.

	Committed Acres of:				
Site No. 6A	Cropland	Pastureland	Forest Land	Other	Total
Dam and Spillway	-	4	20	0	24
Sediment and Water Supply Pools	32	-	163	17*	212
Flood Detention Pool	7	-	365	34**	406
Total	39	4	548	51	642

*includes ponds and streams.
**includes ponds and streams and rights-of-way

All land areas developed with Federal cost-sharing assistance, in accordance with Public Law 566, must remain in the planned use during the evaluated life of the project. They may, however, be assigned to another public agency which will continue to operate and maintain the project for its intended use.

The financial and labor resources invested in the installation of this project, will be irretrievable over the short-term. However, with a favorable benefit-cost ratio, this investment will be recovered through reduced costs and realized opportunities during the project's economic life. The total expended for project installation costs, approximately $1,639,600, including labor and materials required for installing the project, will not be immediately available for other local or national uses. Only the concrete, reinforcing steel, pipe, and the fuel and labor resources expended during the construction of the proposed structure will be totally irreversible or irretrievable over the long-term.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

GENERAL

Activities leading to the development of the Great Creek watershed work plan began in 1955 with the application for assistance, sponsored jointly by the Southside Soil and Water Conservation District, Brunswick County Board of Supervisors, and Town of Lawrenceville. The application was approved, without priority, by the Virginia Soil and Water Conservation Commission in February 1955. A priority was established in June 1965, after some rather serious post-application evaluations of alternatives by the sponsors. Planning authority for development of a watershed work plan was issued by the Administrator of the Soil Conservation Service in May 1971. At that time the following agencies were notified of planning intentions and were requested to furnish any comments or suggestions they might have concerning the project:

United States Army Corps of Engineers
United States Department of Agriculture
- Agricultural Stabilization and Conservation Service
- Farmers Home Administration

United States Department of Health, Education, and Welfare
United States Department of the Interior
- Fish and Wildlife Service
- Bureau of Mines
- Bureau of Outdoor Recreation
- Geological Survey
- National Park Service

United States Environmental Protection Agency
Cooperative Extension Service

Virginia Department of Highways and Transportation
Virginia State Archeologist
Virginia Historic Landmarks Commission
Virginia Department of Conservation and Economic Development
Virginia State Water Control Board
Virginia Commission of Game and Inland Fisheries
Virginia State Department of Health
Virginia Division of Water Resources
Virginia Soil and Water Conservation Commission
Virginia Division of Forestry
Virginia Commission of Outdoor Recreation
Virginia Department of Agriculture and Commerce
Southside Planning District Commission

Information from the U. S. Fish and Wildlife Service was used in describing the fish, wildlife, and recreational values and their potential for development.

The Virginia State Archeologist was consulted. He stated that:

> "I have searched my files and find no record of archeological sites in the area of the project. From my previous knowledge of the area and from a detailed study of the USGS topographical map (Alberta Quadrangle Sheet), I am confident that there are no significant archeological remains in the affected area.
>
> Based on the foregoing, I recommend that you proceed with your project planning. Naturally, when construction begins I will examine the newly-disturbed soil to make sure that no evidence of prehistoric occupancy is overlooked."

The Virginia Historic Landmarks Commission advised that "Millville" - a late 18th, or early 19th century plantation complex, considered eligible for the National Register of Historic Places, is located near U. S. Highway 1. This place would not be affected by the proposed watershed project. The U. S. Army Corps of Engineers replied that the proposed project is not likely to be affected by any plan of development that would be considered in the current study of the Chowan River. The Virginia State Water Control Board provided information relating to water quality in the stream. Publications and other data from the Virginia Division of Planning and Community Affairs provided information relating to ground water resources, mineral resources, economic data, population projections, transportation, and utilities. U. S. Geological Survey topographic maps and surface water data for the area provided basic watershed information. All information received from these agencies was considered during the development of this work plan.

Between February 1955 and June 1974, 30 news articles and 20 pictures relating to activities in the Great Creek watershed appeared in local newspapers. Pamphlets and other communications were distributed through 20 civic organizations and clubs to inform the people of progress in the work plan studies and evaluations. Fifteen public meetings were held to inform the public as to what the watershed project would offer, and to obtain citizen views on the project. Letters of endorsement have been received from 14 civic groups and organizations representing all segments of the community. These letters set forth the environmental, esthetic, and economic values which are of concern to the area.

DISCUSSION AND DISPOSITION OF EACH COMMENT ON DRAFT ENVIRONMENTAL STATEMENT

The agencies which responded to a request for comments on the draft environmental impact statement and plan follow:

Department of the Army
Department of the Interior
Department of Transportation
Environmental Protection Agency
Council on the Environment, Office of the Governor, Commonwealth of Virginia compiled the comments from the following State Agencies:

Virginia Commission of Outdoor Recreation
Virginia State Water Control Board
Virginia Department of Health
Virginia Soil and Water Conservation Commission
Virginia Commission of Game and Inland Fisheries

Virginia Soil and Water Conservation Commission

Agencies and groups which did not respond to a request for comments on the draft environmental impact statement and plan follow:

Council on Environmental Quality
Department of Commerce
Department of Health, Education, and Welfare
Federal Power Commission
Office of Equal Opportunity
Natural Resources Defense Council
Friends of the Earth
Environmental Defense Fund
National Wildlife Federation
National Audubon Society
Environmental Impact Assessment Project

Summary of Comments and Responses

Each issue, problem, or objection is stated and a response given on the following pages. The comments are serially numbered where agencies have supplied multiple comments. The original letters of comment appear in Appendix C.

Department of the Army

(1) Comment: Page II-48, paragraph 5, indicates average annual damages of $15,105 to commercial property and to the municipal water and sewage treatment Plants at Lawrenceville. Page I-29 indicates flood reduction benefits to urban commercial of $14,900. Would the backwater effect from flooding along the Meherrin River cause material flood damage at Lawrenceville?

Response: A 100-year frequency flood on the Meherrin River would cause backwater effects on Great Creek to about the junction of Roses Creek, or the lower end of the project boundary. Lawrenceville could receive material flood damage caused by backwater conditions from a storm of much greater magnitude, or from the combination of maximum backwater and peak flows on Great Creek occurring simultaneously.

Project evaluations are based primarily on damages caused by storms with recurrence intervals of 100 years and less. Storms of greater magnitude have very minor influence on the average annual values when their recurrence interval is considered.

(2) Comment: Page II-58 states:

"One of the major objectives of the plan is to reduce erosion on the watershed, thereby reducing stream pollution from this source. The project will also aid in reducing sedimentation in the Emporia reservoir and downstream in the navigable channels of the Chowan River, the Inter-Coastal Waterway, and Albemarle Sound."

Page I-29 shows estimated average annual damage to downstream reservoirs and channels of $31,605. With reservoir project 6A, the annual damages are reduced by $15,560.

The drainage area of the Meherrin River at Emporia is 747 square miles. The drainage area to be controlled by the project is 41 square miles. It is difficult to appreciate how 41 square miles of controlled area would reduce the sediment damage at the Emporia dam by about 50 percent unless there is much more sediment in Great Creek than in the remainder of the 706 square miles. If so, a greater storage for sediment may be desirable.

Response: Page I-29 (Table 5) deals only with the Great Creek Project area. The $31,605 average annual sediment damages shown in Table 5 arise in Great Creek. Sediment damages arising from other watersheds of the Meherrin were not estimated, since these areas would not be affected by the Great Creek project, see page II-49. The $16,045 estimated average annual benefits arise from Great Creek only.

(3) Comment: OPERATION AND MAINTENANCE

Page I-20, paragraphs 3 and 4 indicate typical operation and vegetative maintenance items. Page I-28 indicates $2,000 for annual operation and maintenance cost. Page I-40 indicates five permanent semi-skilled jobs annually for (a) processing municipal water, (b) recreational use of reservoir, and (c) operation, maintenance, and replacement of project measures. Is a higher estimate than $2,000 for item (c) appropriate?

Response: For project evaluation, operation and maintenance costs include only those items considered necessary to maintain the functional capability and stability of the multiple-purpose structure. Employment and costs associated with processing and distribution of municipal water were not included in the project evaluation. O&M cost for the incidental recreation was accounted for by subtracting $0.90 directly from the $1.50 estimated value per visitor day. The five permanent semiskilled jobs will arise from the overall effects of the project, not from the $2,000 annual O&M cost of the dam. See page I-42.

(4) Comment: RESERVOIR RELEASE RATE

Page I-10, last paragraph, states that the water supply storage of950 acre feet includes allowance for a downstream release rate equal to the 7 day-10 year low flow. Would it be desirable for the watershed plan agreement to state that whatever minimum release is made from the reservoir, is also released by the sponsoring local organization past the water supply intake? This would assure streamflow between the water supply intake and the outfall of the waste treatment plant.

Response: The sponsors are aware of this and, of course, have agreed to operate the structure in compliance with state law and State Water Control Board regulations. It is not necessary to include such a statement in the plan agreement.

(5) Comment: FLOOD PLAIN ZONING

Is it desirable to include flood plain zoning from the proposed dam downstream through the Town of Lawrenceville by the sponsoring local organization (page 61-1)?

Response: Flood plain zoning was considered by both the sponsors and the Soil Conservation Service during project formulation. Flood plain maps (plan and profile) were included as part of the plan and environmental impact statement (see Appendix H). A further discussion concerning flood plain zoning is included under "Projects of Other Agencies" (page II-43).

(6) Comment: SEDIMENT CONCENTRATION

Page I-32 states a sediment concentration of 600 mg/1. How does this compare with a turbidity of 35 mg/1 as shown in Appendix G?

Response: The sediment concentration used was computed using annual sediment delivered and average flows for the same time period. (See footnote on page II-64). Appendix G reflects one sample only.

(7) Comment: DISTRIBUTION OF DRAFT ENVIRONMENTAL IMPACT STATEMENT

Would it be desirable to forward the draft EIS to private conservation organizations and/or individuals with appropriate expertise, in addition to the Federal and state agencies listed on pages II-2 and II-3?

Response: The distribution of the Plan and EIS as prescribed by U.S. Department of Agriculture and Soil Conservation Service procedures are listed on pages II-2 and II-3 of the document. Copies were also supplied to many other agencies, organizations, and individuals. Comments from all sources will be considered in preparation of the Final Plan and EIS.

U.S. Department of the Interior

(1) Comment: Effects of the proposed action on water quality and surface-water regime of the project area are reasonably assessed. However, flood protection measures for the Lawrenceville municipal water plant and sewage treatment plant below the proposed dam should be considered, owing to the inundation of these structures that results from severe storms (page II-48, paragraph 5).

Response: The inundation from severe storms referred to on page II-48 is a description of present flooding problems which relate to "without project" conditions. The Economic and Social effects of the project, page II-65 which describes the "with project" conditions, states that (future) flooding of existing flood plain properties from Great Creek by the 100-year storm will be limited to one foot or less on access roads and parking lots. Minor damage will still occur to the sewage treatment plant from Roses Creek, which is not a part of the project area.

(2) Comment: We find no evaluation of impacts of the proposed dam or impoundment on ground water, either directly in the vicinity of the structure or indirectly, as in changes in the pattern of uses of ground water in the area.

Response: The metamorphic and igneous rocks underlying the pool and surrounding area are quite impermeable and except for joints and fractures the impoundment is not expected to have much effect. If any effect is felt it would be favorable in that the impoundment would allow recharge because of the presence of a continuous source for water in the pool.

Local water tables in the immediate vicinity of the dam and reservoir will rise in small areas adjacent to the permanent pool and downstream of the dam.

(3) Comment: If in addition to hard rock or consolidated rock aquifers, any unconsolidated aquifers such as alluvium are involved, the latter should be described and impacts evaluated.

Response: There are no unconsolidated aquifers of any significance that will be affected by the structure.

(4) Comment: Geologically, the described area is in the Piedmont Physiographic Province and is underlain by a complex of igneous and metamorphic rocks ranging in age from pre-Cambrian to Late Paleozoic. While no mineral production is reported from Lunenburg County, granite for various stone uses and clay and schist for the manufacture of brick are produced in Brunswick County. As stated in the environmental statement, clay materials potentially suitable for various ceramic products are also present in the county.

The work plan indicates that "resource inventories and evaluations will be made..."but there is no mention of mineral resources and it cannot be assumed that these "inventories and evaluations" are to include a mineral appraisal. It is quite possible that deposits similar to those discussed previously also exist within the watershed and could support viable mineral operations. The plan makes no statement regarding the possibility of future mining activity and it can only be surmised that mining has not been considered. Should an economically workable deposit be present in the proposed area of land treatment, the opportunity for sequential multiple-use of the land exists and should be studied.

Response: Any resource inventories and evaluations that would be made would not be complete unless mineral resources were considered. Economically workable deposits are present and if the need arises in the future it can be assumed that crushed stone, clays and building materials will be mined or quarried. This would not be a project induced effect. SCS and the local Soil and Water Conservation District would provide assistance in the event of future mining operations through regular on-going programs.

(5) Comment: The environmental statement provides information concerning the regional geology and nearby mining activity. It is adequate in this regard. Mineral potential within the watershed is not discussed, however, and no appraisal of the project's impact on any local resources is made.

Response: See answer to comment 4.

The project is not expected to have any impact on the mineral resources so no appraisal has been made.

(6) Comment: The final plan should indicate what effect land treatment measures will have on future mining activity. The final environmental statement should provide information regarding the mineral resources committed to the project and the subsequent impact, if any, on local mineral industry.

Response: In the event of any future mining activities land treatment would be geared to alleviate any erosion problems. It does not appear that any mineral resources are committed to the project so there is no subsequent impact. Also see response to comment number 5.

Department of Transportation

(1) Comment: The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

Response: Your review of this plan and EIS is appreciated.

U.S. Environmental Protection Agency

(1) Comment: According to the water quality data found in Appendix G, the stream is presently in good condition. However, no flow data are presented for these samples. Flow data are needed to evaluate possible land runoff effects as well as low flow water quality conditions. Sampling (with flow data) should also be expanded to include areas downstream of Lawrenceville and the Lawrenceville Sewage Treatment Plant to evaluate stream conditions below the project. These data should be included in the final statement.

Response: Mean daily flow for the date of the stream water quality samples collected by the State Water Control Board on 2/12/75 was 60 cfs at the structure site. Raw water samples obtained by the consultant were taken on 6/12/74, 9/19/74, and 10/4/74 at the water treatment plant, with corresponding flows of 18 cfs, 20 cfs, and 12 cfs, respectively. Normal flow, by comparison, is 37 cfs at the site and 39 cfs at the water treatment plant.

(2) Comment: From pages II 30, II 51, and II 52, it appears that the water supply intake at Lawrenceville is at least equal to the 7 day, 10 year low flow of Great Creek. Therefore, the STP at Lawrenceville discharges to the basin, an amount approaching the stream flow during 7-10 low flow conditions. The resulting impact on Great Creek may yield severely depressed dissolved oxygen levels, a bacteriological health hazard, further reductions in desirable aquatic life, and an offensively odorous and unsightly stream from the outfall to the mouth. In order to assess these potential water quality impacts more information is needed, including the degree of treatment, effluent data (including flows), point of discharge into the creek, as well as any plans for updating the treatment level of the STP. The report should also identify the minimum water releases from the proposed reservoir and the effect on the existing flow regimes. If projected residential and industrial growth occurs as a result of the flood protection and increased water supply provided by the project, the volume and complexity of the STP outfall will increase proportionately. Therefore, the present 7 day 10 year low flow will be overwhelmed by the effluent and water quality degraded significantly. It is necessary then to address the impact of the projected growth on water quality. Will the reservoir

have the capacity to supply projected peaks water supply demand and augment flows in Great Creek above the 7 day 10 year low flow to dilute the projected volume of sewage effluent? Will water quality downstream of Lawrenceville and the STP be monitored? Will discharge from the reservoir be regulated to maintain water quality? What criteria will be used as a baseline for maintenance of downstream quality? This area of concern should be addressed in great detail in the final statement.

Response: The table on page II-52 shows 1975 domestic water needs for the Lawrenceville-Alberta service area of 0.32 m.g.d. This compares with domestic consumption of 0.18 m.g.d. for the June-July-August quarter of 1974, which is about equivalent to the 10-year, 7-day guaranteed release of 0.17 m.g.d. Copies of the 1975 operation reports for June and December show average flows at the Lawrenceville sewage treatment plant of 0.13 m.g.d. and 0.18 m.g.d., respectively.

Domestic water needs for the year 2000 are estimated at 0.68 m.g.d. and average flows at the sewage treatment plant are estimated to be 80 percent of this amount. Design loadings for the present plant anticipated a BOD_5 concentration of 36 mg/1, suspended solids of 36 mg/1, and a flow of 0.350 m.g.d. Plant equipment consists of a bar screen, clarifier, trickling filter, and secondary clarifier with Cl_2 contact. A survey by the Virginia State Water Control Board, conducted April 9, 1974, showed the plant to be functioning well within the design limits with little or no odor problems and no apparent effects on the stream.

Average flow at the impoundment site is 37 cfs. The 10-year, 7-day low flow at the junction of Great Creek and Roses Creek, where the treated effluent enters the stream, is 0.48 cfs. It increases to 0.54 cfs 4.8 miles downstream at the confluence of Great Creek with the Meherrin River, and to 15.87 cfs on the Meherrin River below the confluence. The maximum draft rate from the reservoir is 3.50 m.g.d. (5.42 cfs), and flow duration studies show that this value would be exceeded about 75 percent of the time. Therefore, the effect of regulated flows on existing flow regimes is considered to be negligible.

The reservoir is designed for peak demands plus the 7 day 10 year release only.

The stream below the sewage treatment plant will be monitored on a continuous basis starting May 1, 1976 through an agreement between Lawrenceville and the State Water Control Board.

Discharge from the reservoir will be regulated to maintain water quality.

Criteria for maintenance of downstream water quality will be State Water Control Board and Environmental Protection Agency standards.

Representatives of Lawrenceville, the County, State Water Control Board and Soil Conservation Service met in Lawrenceville on March 25, 1976 to discuss the above comments. Lawrenceville and State Water Control Board have mutually agreed for the State Water Control Board to assist Lawrenceville by training operators, monitoring releases, and developing guidelines for operation.

Lawrenceville and the State Water Control Board jointly drafted a resolution for implementation of a program to provide for necessary quality and quantity of flow in Great Creek in order to maintain State present water quality standards. (A copy of the subsequent resolution was forwarded to E.P.A.)

The guidelines will be included in a specific operations and maintenance agreement between the Soil Conservation Service and the sponsors.

(3) Comment: Existing water temperature during the year should be given and expected changes for impounded and downstream waters defined. Will there be any impact on aquatic biota due to temperature changes?

Response: Existing water temperature ranges are shown on page II-38, paragraph 2, and in Appendix G. Field studies conducted by SCS Biologists on small impoundments indicate a 1.0 to 4.0 F. degree rise in surface water temperature in this reservoir. These studies also show that temperature rises of this magnitude normally recover in one-fourth mile or less down stream after release.

With three water supply release gates located at different depths, the warm surface water can be blended with cooler water from below the surface. Lawrenceville and the Virginia State Water Control Board have mutually agreed for the State Water Control Board to assist by training operators, monitoring releases, and developing guidelines for operation.

Aquatic biota downstream of the reservoir will not be adversely affected by thermal pollution.

(4) Comment: On page II 30, the 7 day 10 year low flow is given as .17 MGD for Great Creek. A quick review of the flow for the USGS station on Great Creek near Cochran, Virginia, indicates that this figure may be low, especially when the additional drainage area from the gaging station to the dam site is considered. For this reason, an explanation of the method and data used to calculate the 7 day 10 year low flow should be supplied in the report.

Response: The 0.17 m.g.d. (10-year, 7-day low flow) may be low when compared to flow records for the Great Creek gage. No such analysis has been made for this gage at the present time, however, since it did not have a sufficient length of record at the time the most recent study of this kind was made for Virginia streams. An inspection of the publication "Water Resources Data for Virginia" shows one 7-day period with a mean low flow equal to the estimated value of 0.17 m.g.d. (September 16-22, 1965) and another 7-day period with a mean low flow of 0.24 m.g.d. (Octover 10-16, 1965). The minimum 1-day flow for the period of record (15 years) is 0.085 m.g.d. or one-half the 10-year, 7-day value used. The above values have been adjusted to include the additional drainage area at the site.

The mean 10-year, 7-day low flow for ungaged watersheds, or for gaged areas with insufficient length of record, is usually determined by transferring data from a gaged to an ungaged site by relating flow characteristics to basin characteristics. The low flow characteristics of a stream are usually the least accurate type of flow characteristics, with the standard error of estimate ranging in excess of 100 percent. Therefore, it is usually desirable to average these values for more than one gaged site with comparable drainage areas as well as other basin characteristics. The foregoing considerations led to the selection of two gages in the Chowan Basin, Nottoway River near Burkeville and North Meherrin River near Lunenburg, for this purpose.

(5) Comment: Page I 10, does not clearly define the release rate during drought low flow periods. How often will the 76 acres of mudflats be exposed? What impact will this have on public health?

What impact will more intensive use of the flood plain for agriculture have on water quality considering increased fertilizer, pesticides, and animal wastes will be entering the Creek? What measures do the sponsors propose to regulate residential and industrial growth to protect and maintain present good water quality?

Response: The narrative on page I-10 has been modified to clearly define the 10-year, 7-day low flow as a guaranteed minimum value of 0.17 m.g.d.

A water budget analysis, based on the entire period of record for the Great Creek gage near Cochran, has been run and shows three drought periods for the 15 years of record. Two of these periods would expose the entire drawdown area of 76 acres, while the third one would expose 50 acres. The longest drawdown period, below maximum pool level, is 7 months. Flow duration studies show that the maximum draft rate of 3.50 m.g.d. (5.42 cfs) would be exceeded 75 percent of the time. This means that drawdown of the water supply pool would only occur during periods when streamflow is much below normal. Furthermore, the average land slope of the drawdown area is 5.9 percent. Therefore, the impact on public health from the operation of the water supply structure is expected to be minimal.

Basically, pesticides and fertilizers develop a bond with the soil. The primary means of these elements reaching the stream would be through erosion.

Fertilizers are absorbed into plants through the root system. U.S. Forest Service Research Note SE-108, February 1969, concludes that the use of herbicides, even on steep mountain land, does not appear to constitute a pollution hazard as long as erosion is controlled and when care is taken to protect streamside vegetation and the channel itself from direct contamination.

"The movement of sediments and phosphorus into waterways depends more directly on the nature of the surrounding landscape than on the extent of agriculture

in the watershed," according to Cornell University researchers 1/. They also found that: "The most crucial factor determining the degree of phosphorus pollution and sedimentation was the slope of the farmed land" 1/.

"Those lands in our study that were most intensively farmed contributed the least phosphorus to the waterways. On the other hand, part of the watershed that was farmed lightly contributed disproportionately high amounts of phosphorus and sediments" 1/.

If the project is installed, flooding and scouring of the flood plain will be reduced approximately 60 percent. Therefore, the nutrients applied to the flood plain soils are not lost through erosion to the degree they would be without flood protection.

The county has a comprehensive land use plan under development. Urban and other intensive development is restricted by the Virginia Building Code and local ordinances and regulations. See page II-43 for information concerning the National Flood Insurance Program.

1/ Runoff Sources Pinpointed, New York State College of Agriculture and Life Sciences, a Statutory College of the State University, Cornell University Press Service, Roberts Hall, Ithaca, New York 14850.

Commonwealth of Virginia, Office of the Governor, Council on the Environment

Virginia Commission of Outdoor Recreation

(1) Comment: The Virginia Commission of Outdoor Recreation has expressed concurrance with the Soil Conservation Service in that this lake will help meet the demand for fishing acres in this area. They question, however, if the provision of one five acre access point on a 212 acre lake with six plus miles of shoreline will be enough. They suggest that other recreational land sites be found along the shore of the lake and preserved for future use. In this way unwarranted development could be prevented and recreational facilities could be increased in the future as the need arises.

Response: Public fishing and the incidental recreation are not part of the planned project and will be installed and managed by Brunswick County in cooperation with the Virginia Commission of Game and Inland Fisheries. Brunswick County considers one access point sufficient to meet their needs. No other governmental unit has agreed to cost share on any other recreational development at this site. Brunswick County will purchase a 50-foot strip around the reservoir and obtain flowage easements for 618-acre retarding pool which will aid in preventing detrimental development.

(2) Comment: The Virginia Commission of Outdoor Recreation notes that the Soil Conservation Service made use of their 1970 Outdoor Plan in the writing of this report. That plan is outdated and has been replaced by their 1974 Virginia Outdoors Plan. That document should be used. The Virginia Commission of Outdoor Recreation would be more than happy to send you a copy upon request.

Response: Pages II-53 and 55 have been changed to reflect the use of the Virginia Outdoors Plan, 1974. Thank you for providing a copy.

State Water Control Board

(A1) Comment: Stratification of the proposed reservoir will possibly occur during the summer months. Generally, the surface layers, epilimnion, of stratified bodies of water have a higher dissolved oxygen and temperature than the deeper bottom layers, hypolimnion, which are typically colder and lower in dissolved oxygen. It is possible to control water quality, i.e. temperature and dissolved oxygen, of the releases from a dam of a stratified water mass by selectively regulating the level from which water is withdrawn and differentially mixing

water withdrawn from upper and lower strata, the epilimnion and hypolimnion, respectively.

According to the subject document, three 12-inch gates will be installed in the riser at different levels. There is no information provided which would indicate that the three gates will be used to regulate the water quality of the discharge.

To assure compliance with Virginia Water Quality Standards, and thus, prevent the degradation of downstream water quality in Great Creek, a program for water quality regulation of releases should be developed. A monitoring station for collection of dissolved oxygen and temperature data should be established downstream from the dam. Based on aforementioned data, the discharge of dam should be controlled, as discussed previously, to maintain dissolved oxygen and temperature pursuant to State standards for Great Creek (classified as Class III-A).

Response: The Brunswick County Board of Supervisors have agreed to exercise such vested powers as they may have to operate structure 6A in compliance with regulations pertaining to Virginia Water Quality Standards. The following is a quote from a resolution by the Board of Supervisors: "BE IT RESOLVED THAT, Brunswick County will take such action as is within its means to comply with Virginia Water Quality Standards in the operation of structure number 6A. This will include monitoring or releases during times when stratification may occur so that water with low dissolved oxygen will not be released to the detriment of downstream aquatic systems but will be done so as not to reduce the water supply to the Town of Lawrenceville.

"AND FURTHER THAT, recreation user fees will be nominal so as to not exclude use by low income groups.

"A true copy: /s/ Jesse L. Fowler, Jr."

(A2) Comment: As indicated by the subject document, one of the major functions of the reservoir is storage basin for sediment entering Great Creek from upstream watershed. Associated with this influx of sediment to the reservoir will be nutrients from non-point sources, i.e. fertilizers from farmlands and nitrogenous wastes from pastureland. (An additional source of nutrients will be fertilizers applied in the establishment of the vegetative land treatment measures outlined on pages II-7 to II-10).

In view of the continued importance of farming and grazing activities in the Great Creek Watershed, nutrient enrichment of the project reservoir seems likely. Coupled with sedimentation (about 12,000 tons per year, estimated from Figure 11, page II-50); this nutrient enrichment will accelerate the eutrophication of the reservoir, eventually, causing appearance of algal blooms and a reduction of dissolved oxygen concentrations.

Eutrophication would severely impair the viability of the reservoir to serve as a public water supply and would negate its attractiveness for public recreation. In addition, the regulated releases from the dam would have lower dissolved oxygen concentrations; thus, downstream water quality in Great Creek could be affected.

Response: Field studies have shown that establishment of vegetative land treatment practices reduces erosion, thereby reducing the amount of enriched sediment delivered. Instead of accelerating eutrophication, land treatment and good farm management will prolong the useful life of the reservoir.

(A3) Comment: As outlined on page II-9, under Forest land, insect and disease control are planned on 6,980 acres as part of the land treatment measures for the watershed. A definition of the quantity and quality of pesticides, fungicides, and other chemical control agents to be used and an evaluation of the potential impacts of these substances on aquatic life in Great Creek should be provided in final EIS.

Response: The Virginia Division of Forestry responded to this comment. Their active disease and insect control program consists primarily of removal of trees infested with the Southern Pine Beetle. They state that..."Since very little, if any, chemical treatment will be recommended there should be very little, if any, adverse effects on water."

(B1) Comment: To minimize sedimentation, construction of the multipurpose structure should be scheduled for the dry months of the year. In addition, cofferdams should be constructed downstream of the proposed dam, to reduce the effect of dam building activities on turbidity in Great Creek.

Response: The Plan and EIS provide for control of erosion during construction. See paragraph three, page II-12.

(B2) Comment: As to the engineering design, the reservoir will be abnormally shallow. At full flood storage, the maximum depth will be 52.1 feet, averaging nineteen feet. The sediment pool will have a maximum depth of twenty feet, while averaging only 6.75 feet. The geomorphologic nature of the channel is not generally acceptable for reservoirs, as indicated by the fact that the average depth with storage of public water supplies will be less than that of the sediment pool, only 5.36 feet. This will lead to mud flats of up to 406 acres (65% of the maximum inundated area) due to the simple release of flood storage.

Response: The sediment pool for this structure has a maximum depth of 13.5 feet and an average depth of 6.3 feet. The maximum and average values for the water supply pool are 19.2 feet and 8.5 feet, respectively. The maximum flood pool will have a maximum depth of 44.6 feet and an average depth of 19.2 feet. These figures compare favorably with other sites in the Piedmont physiographic area of the state, with comparable storage characteristics.

The 406 acres in the flood storage pool is between the water supply pool and the emergency spillway crest. The total area inundated by the 100-year flood storage is only 283 acres, with a drawdown time of about 7 days. Therefore, no mudflats are expected to occur in the flood pool. See response to Environmental Protection Agency comment 5 for a discussion of the 76 acres in the drawdown area of the water supply pool.

(B3) Comment: The USGS guage will probably not be needed when the stream flow is controlled by the structure. Local authorities could read and record flows from the facility. The USGS and SWCB should be contacted for elaboration of this aspect of the plan.

Response: The sponsors will determine the need for this gage on a voluntary basis and consult with USGS and SWCB as to final disposition.

(B4) Comment: Some recreational uses and public water supplies may be incompatible. Many localities regulate or prohibit primary contact recreation (swimming) and power boating in their raw water supplies. The new Federal Regulations for the Drinking Water Act should also be reviewed.

Response: Agreed. The sponsors have been appraised of this and have elected to limit recreation use.

State Health Department

(1) Comment: Since this is Lawrenceville's main source of drinking water, residential development, with its accompanying sewage disposal requirements, should be discouraged. This could be accomplished by zoning or other action at the local level.

Response: The sponsors are aware that problems can arise if urban type development takes place around the lake. Regulations are being evaluated to prevent undesirable land uses in the area.

(2) Comment: The use of the reservoir as an intensive recreation facility with the use of gasoline operated motorboats, etc., should not be allowed.

Response: Fish and wildlife use of the structure will be a non-project feature, only incidental to the project, as no storage was planned for this purpose. The sponsors plan to prohibit the use of gasoline powered motors, and other similar equipment which will adversely affect water quality.

(3) Comment: Surveillance must be maintained to prevent nuisance conditions from developing. These nuisances could result from concentrated recreation activities - problems with litter, solid waste disposal, and wastewater disposal are among the several items that immediately come to mind.

Response: The Operations and Maintenance Provisions (Page I-20) address these problems. Provisions require that all facilities be installed, operated and maintained in conformance to state and local health laws and regulations.

(4) Comment: The Town should also be prepared to provide corrective action to the water in the reservoir if remedies are needed. These actions may include the use of copper sulfate for control of algae, the use of carbon at the water plant if tastes and odors are detected, etc.

Response: Brunswick County will be responsible for operation and maintenance of the structure. See Page I-20, paragraphs 2 and 3, and Page II-16, and response to comment number 3.

(5) Comment: Attached are policy statements by the AWWA in which classification of various impoundments are given. We feel that this impoundment should be classed as a Class B (as a minimum) Reservoir with regards to its use.

Response: The planned functions of the proposed structure are floodwater and sediment control and water supply storage. The sponsors agree to operate and maintain it for those purposes in conformance to all applicable state and local laws and regulations. See page I-20 and II-16 and II-17.

(6) Comment: With adequate water recreation sites elsewhere in the area - Lake Gaston for example - we feel that there would certainly be no need for this reservoir to become a major recreation site. This is brought out in the Report on Page II-5 in which three purposes are stated. We agree with the purposes, which we feel are excellent.

Response: Agreed. Recreational type use is only incidental to the project. See response to comment 2.

(7) Comment: Multiple withdrawal points at the outlet structure of the reservoir are desirable.

Response: Provisions are made for multiple level withdrawal gates. See page II-12, second full paragraph.

Commission of Game and Inland Fisheries

(1) Comment: Technically, the stream classification attributed to the Commission was carried out by the U.S. Fish and Wildlife Service according to U.S.F.W.S. criteria. Their criteria differs somewhat from that of the Commission. Also, the system utilized was a modification of the Van Deusen system and classifications were not strictly according to the system cited.

Response: The first sentence of Paragraph 1, page II-38, has been changed to read: "Great Creek and its tributaries are warm water streams containing low fish populations." The classification reference at the bottom of page II-38 has been deleted.

(2a) Comment: Possible increases in ferrous iron and manganese levels in downstream waters as a result of the proposed impoundment (II-30, para. 4 i.e. water high in iron and manganese), the release of lower level waters from the impoundment during wet periods (in the region of the chemocline), the subsequent reduction of any heavy metals as waters become oxygenated after discharge, and the probable precipitation of iron and manganese oxides (or other inactive forms) has not been discussed

under Water Quality Problems or under Adverse Environmental Effects. This potential problem should be described in detail in the final draft since the stated occurrences are not uncommon in areas rich in iron and manganese.

Response: The water supply gates will be removing water from the top 5 feet of the reservoir which would not contain any higher concentrations of iron and manganese than would occur in Great Creek normally. During dry periods the minimum flow gate will permit removal of water five feet above the bottom of the reservoir. This water may contain slightly higher concentrations than that taken near the top. However, it was not determined to be a significant adverse environmental effect or a water quality problem.

(2b) Comment: Additionally, no discussions of downstream environmental effects were provided and this oversight should be remedied in the final draft. In particular, the effect of decreasing streamflow by an average of 3.0 million gallons of water per day (4.64 c.f.s.) on aquatic organisms located below the water supply diversion was not discussed under Water Quality Problems or under Adverse Environmental Effects. Surely such a marked reduction in streamflow would have certain adverse consequences to streamlife. Also, re-regulation of streamflow will have certain beneficial (reducing sediment loading) and detrimental effects (differing temperature patterns, differing flow patterns, decreased flow due to evaporation, etc.) yet no information regarding these effects or estimates of their probable severity have been provided.

Response: The estimated total demand by the year 2000 of 3.5 million gallons of water per day will be obtained both from storage and normal stream flow except when flows are less than the 7-day, 10-year low flow at whichtime the entire water supply will be obtained from storage. Further, the 7-day, 10-year low flow released from the reservoir will be bypassed at the new water intake. Only 3.57 percent of the total average annual flow will be stored and flow patterns will not be changed. Sediment will be reduced below the reservoir. Water will be removed from the top 5 feet of the reservoir normally which will reduce the incidence of water temperature fluctuations. Field studies by SCS indicated an increase in downstream low flows after construction of a dam. This increase results from projected

outflow of floodwaters, seepage from the reservoir and interception of sub-surface flows by the cut-off wall. The severity of flood flows will be reduced.

Also see response to Environmental Protection Agency comments (2) and (3).

(3) Comment: The argument that accelerated conservation land treatment would not be possible without the project, and an increase in installation time from 5 to 40 years, does not appear germane to the 'No Project' alternative. Other projects could be developed and substituted which would provide the same levels of "accelerated conservation land treatment."

Adverse effects on stream ecology (outlined above) would also be avoided by a no project alternative.

Response: The "No Project" alternative does not infer that accelerated conservation land treatment would not be possible without the project, only that the needed land treatment would not be installed as rapidly. Technical assistance would not be as available without the project as with it. According to SCS biologists, the project will not adversely affect stream ecosystems.

(4) Comment: The statement that "the project will improve water quality and quality of wildlife habitat", may or may not be true. Heavy metal precipitation below the impoundment may offset any gains provided by reduced sedimentation. Decreased streamflow and changes in flow patterns may also decrease water quality.

Response: See 2a and 2b above.

(5a) Comment: We are pleased to note on page I-11, para. 2 that the impoundment planned for the Great Creek Watershed Project includes plans for public fishing access and facilities. Flood plain zoning and the securing of land rights for an access road (page I-19) are also to be commended.

Response: Thank you for your comments.

(5b) Comment: According to the next to last sentence in para. 5, page I-19, a total of five acres will be purchased for (among other things) bank fishing purposes. No mention is made regarding whether shoreline access to the remaining 4.8 miles of shoreline will be available to the general public. It is recommended that a narrow band of additional shoreline sections be purchased as part of the project for fishermen access purposes if no other shoreline sections will be available.

Response: Actually 8.1 miles of shoreline will be available to the public. The following statement will be added after the third sentence of paragraph 5, page I-19, "Also, the county will purchase a 50-foot strip around the perimeter of the permanent pool for bank fishing and other recreational activities." Appropriate changes will be made to paragraph 3, page II-13.

Virginia Soil and Water Conservation Commission

(1) Comment: The Work Plan and Environmental Impact Statement for Great Creek Watershed has been reviewed as requested in your letter dated October 10, 1975. I believe that this project will be a tremendous asset to the citizens of this Southside community by reducing flooding, providing an adequate municipal water supply and reducing sedimentation in Great Creek. We have no comments to offer on either the Plan or the Environmental Impact Statement.

Response: We appreciate your review and comment, and wish to thank you for your continued interest and support.

LIST OF APPENDIXES

APPROVED BY /s/ D. N. Grimwood DATE May 14, 1976

D. N. Grimwood
State Conservationist

APPENDIX A - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Great Creek Watershed, Virginia

(Dollars)

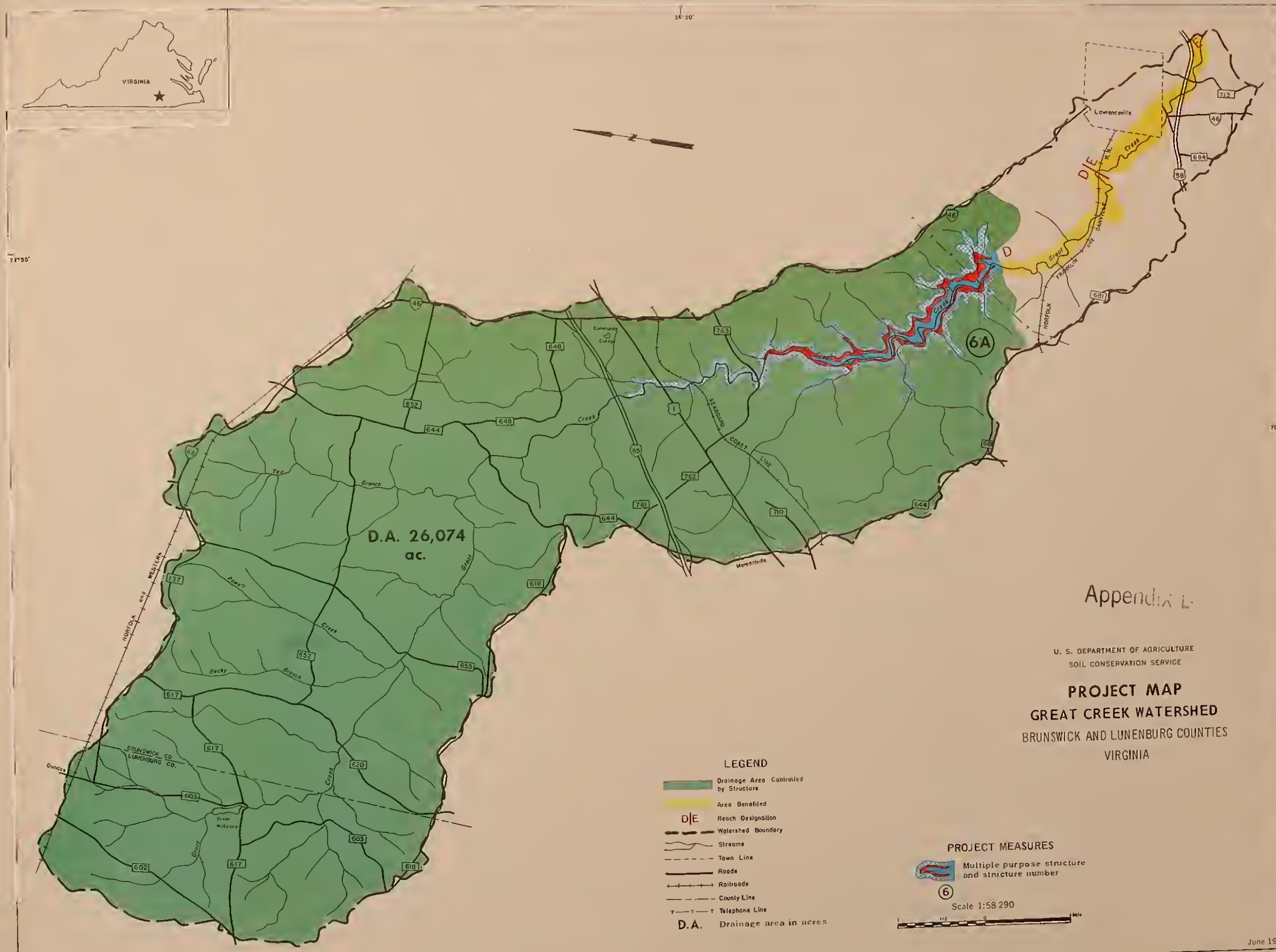
Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 3/	Benefit Cost Ratio
	Damage 2/ Reduction	More Intensive Land Use Agr.	Changed Land Use Agr.	Muni-cipal Water Supply	Incidental Recreation	Local Secondary	Total		
Multiple-Purpose Structure	42,395	10,785	7,500	37,890	7,200	14,765	120,535	81,370	1.5:1.0
Project Administration								7,680	
GRAND TOTAL	42,395	10,785	7,500	37,890	7,200	14,765	120,535	89,050	1.4:1.0

1/ Price Base: 1974 - Agricultural values, 1974 Current Normalized Prices; all other values current (1974) prices.

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $4,155 annually.

3/ Amortized 100 years @ 6-1/8 percent interest.

Date: April 1976



Appendix L

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP
GREAT CREEK WATERSHED
BRUNSWICK AND LUNENBURG COUNTIES
VIRGINIA

June 1973

SOURCE: Base map furnished by Field dated March 1973

USDA-SCS-HYATTSVILLE MD 1973

APPENDIX C

Letters of Comment Received on the Draft Environmental Impact Statement

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

11 NOV 1975

Honorable Robert W. Long
Assistant Secretary of Agriculture
Washington, D.C. 20250

Dear Mr. Long:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Virginia State Conservationist of the Soil Conservation Service, by letter of 10 October 1975, requested the views of the Secretary of the Army on the watershed plan for Great Creek Watershed, Virginia.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned.

Specific comments on the watershed plan and draft environmental impact statement are inclosed.

Sincerely,

Donald B Duncan

1 Incl
As stated

for Charles R. Ford
Deputy Assistant Secretary of the Army
(Civil Works)

COMMENTS ON

DRAFT PLAN AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

ON GREAT CREEK WATERSHED

BRUNSWICK AND LUNENBURG COUNTIES, VIRGINIA

1. FLOOD DAMAGE

Page II-48, paragraph 5, indicates average annual damages of $15,105 to commercial property and to the municipal water and sewage treatment Plants at Lawrenceville. Page I-29 indicates flood reduction benefits to urban commercial of $14,900. Would the backwater effect from flooding along the Meherrin River cause material flood damage at Lawrenceville?

2. SEDIMENT

Page II-58 states:

> "One of the major objectives of the plan is to reduce erosion on the watershed, thereby reducing stream pollution from this source. The project will also aid in reducing sedimentation in the Emporia reservoir and downstream in the navigable channels of the Chowan River, the Inter-Coastal Waterway, and Albemarle Sound."

Page I-29 shows estimated average annual damage to downstream reservoirs and channels of $31,605. With reservoir project 6A, the annual damages are reduced by $15,560.

The drainage area of the Meherrin River at Emporia is 747 square miles. The drainage area to be controlled by the project is 41 square miles. It is difficult to appreciate how 41 square miles of controlled area would reduce the sediment damage at the Emporia dam by about 50 percent unless there is much more sediment in Great Creek than in the remainder of the 706 square miles. If so, a greater storage for sediment may be desirable.

3. OPERATION AND MAINTENANCE

Page I-20, paragraphs 3 and 4 indicate typical operation and vegetative maintenance items. Page I-28 indicates $2,000 for annual operation and maintenance cost. Page I-40 indicates five permanent semi-skilled jobs annually for (a) processing municipal water, (b) recreational use of reservoir, and (c) operation, maintenance, and replacement of project measures. Is a higher estimate than $2,000 for item (c) appropriate?

4. RESERVOIR RELEASE RATE

Page I-10, last paragraph, states that the water supply storage of

950 acre feet includes allowance for a downstream release rate equal to the 7 day-10 year low flow. Would it be desirable for the watershed plan agreement to state that whatever minimum release is made from the reservoir, is also released by the sponsoring local organization past the water supply intake? This would assure streamflow between the water supply intake and the outfall of the waste treatment plant.

5. FLOOD PLAIN ZONING

Is it desirable to include flood plain zoning from the proposed dam downstream through the Town of Lawrenceville by the sponsoring local organization (page 6I-1)?

6. SEDIMENT CONCENTRATION

Page I-32 states a sediment concentration of 600 mg/1. How does this compare with a turbidity of 35 mg/1 as shown in Appendix G?

7. DISTRIBUTION OF DRAFT ENVIRONMENTAL IMPACT STATEMENT

Would it be desirable to forward the draft EIS to private conservation organizations and/or individuals with appropriate expertise, in addition to the Federal and state agencies listed on pages II-2 and II-3?

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-75/992

JAN 13 1976

Dear Mr. Grimwood:

Thank you for the letter of October 10, 1975, requesting our views and comments on the draft environmental statement and work plan for Great Creek Watershed, Brunswick and Lunenburg Counties, Virginia. We have reviewed the documents and conclude that they adequately consider those areas within our jurisdiction and expertise, except for several suggestions offered below.

Effects of the proposed action on water quality and surface-water regime of the project area are reasonably assessed. However, flood protection measures for the Lawrenceville municipal water plant and sewage treatment plant below the proposed dam should be considered, owing to the inundation of these structures that results from severe storms (page II-48, paragraph 5).

We find no evaluation of impacts of the proposed dam or impoundment on ground water, either directly in the vicinity of the structure or indirectly, as in changes in the pattern of uses of ground water in the area. If in addition to hard rock or consolidated rock aquifers, any unconsolidated aquifers such as alluvium are involved, the latter should be described and impacts evaluated.

Geologically, the described area is in the Piedmont Physiographic Province and is underlain by a complex of igneous and metamorphic rocks ranging in age from pre-Cambrian to Late Paleozoic. While no mineral production is reported from Lunenburg County, granite for various stone uses and clay and schist for the manufacture of brick are produced in Brunswick County. As stated in the environmental statement, clay materials potentially suitable for various ceramic products are also present in the county.

The work plan indicates that "resource inventories and evaluations will be made..." but there is no mention of mineral resources and

it cannot be assumed that these "inventories and evaluations" are to include a mineral appraisal. It is quite possible that deposits similar to those discussed previously also exist within the watershed and could support viable mineral operations. The plan makes no statement regarding the possibility of future mining activity and it can only be surmised that mining has not been considered. Should an economically workable deposit be present in the proposed area of land treatment, the opportunity for sequential multiple-use of the land exists and should be studied.

The environmental statement provides information concerning the regional geology and nearby mining activity. It is adequate in this regard. Mineral potential within the watershed is not discussed, however, and no appraisal of the project's impact on any local resources is made.

The final plan should indicate what effect land treatment measures will have on future mining activity. The final environmental statement should provide information regarding the mineral resources committed to the project and the subsequent impact, if any, on local mineral industry.

We hope these suggestions and comments will be of assistance to you.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Mr. D. N. Grimwood
State Conservationist
Soil Conservation Service
Department of Agriculture
P. O. Box 10026
Richmond, Virginia 23240

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE: (202) 426-2262

16 DEC 1975

Mr. D. N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

This is in response to your letter of 10 October 1975 addressed to the Commandant, U. S. Coast Guard concerning a draft environmental impact statement for the Great Creek Watershed, Brunswick and Lunenburg Counties, Virginia.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,

D. J. RILEY
Captain, U. S. Coast Guard
Deputy Chief, Office of
Environment and
By direction of the

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

December 8, 1975

Mr. D. N. Grimwood
State Conservationist
United States Department
of Agriculture
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

We have completed our review of the Draft Plan and Draft Environmental Impact Statement for the Great Creek Watershed. We have the following comments:

1) According to the water quality data found in Appendix G, the stream is presently in good condition. However, no flow data are presented for these samples. Flow data are needed to evaluate possible land runoff effects as well as low flow water quality conditions. Sampling (with flow data) should also be expanded to include areas downstream of Lawrenceville and the Lawrenceville Sewage Treatment Plant to evaluate stream conditions below the project. These data should be included in the final statement.

2) From pages II 30, II 51, and II 52, it appears that the water supply intake at Lawrenceville is at least equal to the 7 day, 10 year low flow of Great Creek. Therefore, the STP at Lawrenceville discharges to the basin, an amount approaching the stream flow during 7-10 low flow conditions. The resulting impact on Great Creek may yield severely depressed dissolved oxygen levels, a bacteriological health hazard, further reductions in desirable aquatic life, and an offensively odorous and unsightly stream from the outfall to the mouth. In order to assess these potential water quality impacts more information is needed, including the degree of treatment, effluent data (including flows), point of discharge into the creek, as well as any plans for updating the treatment level of the STP. The report should also identify the minimum water releases from the proposed reservoir and the effect on the existing flow regimes. If projected residential and industrial growth occurs as a result of the flood protection and increased water supply provided by the project, the volume and complexity of the STP outfall will increase proportionately.

Therefore, the present 7 day 10 year low flow will be overwhelmed by the effluent and water quality degraded significantly. It is necessary then to address the impact of the projected growth on water quality. Will the reservoir have the capacity to supply projected peaks water supply demand and augment flows in Great Creek above the 7 day 10 year low flow to dilute the projected volume of sewage effluent? Will water quality downstream of Lawrenceville and the STP be monitored? Will discharge from the reservoir be regulated to maintain water quality? What criteria will be used as a baseline for maintenance of downstream quality? This area of concern should be addressed in great detail in the final statement.

3) Existing water temperature during the year should be given and expected changes for impounded and downstream waters defined. Will there be any impact on aquatic biota due to temperature changes?

4) On page II 30, the 7 day 10 year low flow is given as .17 MGD for Great Creek. A quick review of the flow for the USGS station on Great Creek near Cochran, Virginia, indicates that this figure may be low, especially when the additional drainage area from the gaging station to the dam site is considered. For this reason, an explanation of the method and data used to calculate the 7 day 10 year low flow should be supplied in the report.

5) Page I 10, does not clearly define the release rate during drought low flow periods. How often will the 76 acres of mudflats be exposed? What impact will this have on public health?

What impact will more intensive use of the flood plain for agriculture have on water quality considering increased fertilizer, pesticides, and animal wastes will be entering the Creek? What measures do the sponsors propose to regulate residential and industrial growth to protect and maintain present good water quality?

On the basis of our review we have placed the project in EPA Reporting Category ER-2. I have enclosed a sheet explaining this rating system. The classification and date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed actions under Section 309 of the Clean Air Act.

We will be glad to furnish whatever assistance we can in resolving the inadequacies found in the Draft Environmental Impact Statement, prior to writing the Final Environmental Impact Statement.

Sincerely yours,

Nicholas M. Ruha

Nicholas M. Ruha
Chief
EIS and Wetlands Review Section

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

April 5, 1976

Mr. D. N. Grimwood
State Conservationist
United States Department
of Agriculture
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

Dear Mr. Grimwood:

We have reviewed your responses addressing the concerns we expressed in our review of the Draft EIS on Great Creek Watershed. We find that the additional information and modification you propose will satisfactorily answer our comments.

There are no unresolved comments and we concur in the adequacy of the proposed changes in the Final EIS.

Thank you for the opportunity to review and comment on the project as well as for your cooperation in revising the statement.

Sincerely yours,

Nicholas M. Ruha
Chief
EIS and Wetlands Review Section

COMMONWEALTH of VIRGINIA

Council on the Environment

GERALD P. McCARTHY
ADMINISTRATOR

903 NINTH STREET OFFICE BUILDING
RICHMOND 23219

January 27, 1976

Mr. David N. Grimwood
State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
P.O. Box 10026
Richmond, Virginia 23240

Subject: Great Creek Watershed, Brunswick and Lunenburg Counties, Virginia

Dear Mr. Grimwood:

We have reviewed the Work Plan and Draft Environmental Impact Statement for the subject project. The following agencies participated in this review:

Division of State Planning and Community Affairs
State Water Control Board
State Department of Health
Commission of Game and Inland Fisheries
Marine Resources Commission
State Air Pollution Control Board
Virginia Institute of Marine Science
Commission of Outdoor Recreation
Historic Landmarks Commission
State Department of Agriculture and Commerce
State Corporation Commission
State Department of Conservation and Economic Development
Southside Planning District Commission
Piedmont Planning District Commission

The two agencies which have been most closely involved in the planning process for this project have offered their concurrence with the material presented in the document and have reiterated their endorsement of the proposal. (These are the Southside Planning District Commission and the Virginia Soil and Water Conservation Commission.)

Of the other agencies responding, three have expressed concern with respect to water quality. These are the State Water Control Board, State Department of Health and the Commission of Game and Inland Fisheries. To give you a clear idea of their particular interests, perspectives and recommendations on this issue, their comments have been attached separately, rather than consolidated. It is suggested that you contact the individuals listed below to discuss their concerns, and that the Soil Conservation Service provide an appropriate response in the Final Environmental Impact Statement for the project:

Mr. J. L. Hamrick, Director
Environmental Affairs, Bureau
of Enforcement
State Water Control Board
2111 North Hamilton Street
P.O. Box 11143
Richmond, Virginia 23230
786-1411

Mr. Oscar H. Adams, Director
Division of Engineering
State Department of Health
Madison Building
Richmond, Virginia 23219
786-6277

Mr. James F. McInteer, Jr.
Assistant Director
Commission of Game and Inland
Fisheries
4010 West Broad Street
Richmond, Virginia 23230
786-4974

The Virginia Commission of Outdoor Recreation has expressed concurrance with the Soil Conservation Service in that this lake will help meet the demand for fishing acres in this area. They question, however, if the provision of one five acre access point on a 212 acre lake with six plus miles of shoreline will be enough. They suggest that other recreational land sites be found along the shore of the lake and preserved for future use. In this way unwarranted development could be prevented and recreational facilities could be increased in the future as the need arises.

Furthermore, the Virginia Commission of Outdoor Recreation notes that the Soil Conservation Service made use of their 1970 Outdoor Plan in the writing of this report. That plan is outdated and has been replaced by their 1974 Virginia Outdoors Plan. That document

should be used. The Virginia Commission of Outdoor Recreation would be more than happy to send you a copy upon request. Please contact:

Mr. Art Buehler
Assistant Director
Commission of Outdoor Recreation
Eighth Street Office Building
Richmond, Virginia 23219
786-2036

In view of the concerns of the several agencies noted previously regarding water quality, there is a possibility of conflict in use of the reservoir between some types of recreation and public water supply. If satisfactory agreements cannot be achieved through your discussions with the individuals noted in this letter, it may be necessary for the Soil Conservation Service to meet with all interested state representatives. The Council on the Environment would be glad to arrange for such a meeting, if necessary.

We look forward to continuing to work with you to arrive at a well-planned project. Thank you very much.

Sincerely,

Gerald P. McCarthy

GPM:dls

Attachments: Three

cc: Honorable Earl J. Shiflet, Secretary of Commerce and Resources
Honorable James Ryan, Assistant Attorney General
Mr. J. L. Hamrick, State Water Control Board
Mr. Oscar H. Adams, State Health Department
Mr. James F. McInteer, Jr., Commission of Game and Inland Fisheries
Mr. Rob R. Blackmore, Virginia Commission of Outdoor Recreation

REVISED

COMMENTS SUBMITTED BY

STATE WATER CONTROL BOARD

FOR
GREAT CREEK WATERSHED
BRUNSWICK AND LUNENBURG COUNTIES

The subject document does not provide an adequate assessment of the potential impacts of the proposed land treatment measures on water quality. Of greatest concern to this agency was the failure of the subject document to provide evaluative information on the following water quality-related impacts:

1. Stratification of the proposed reservoir will possibly occur during the summer months. Generally, the surface layers, epilimnion, of stratified bodies of water have a higher dissolved oxygen and temperature than the deeper bottom layers, hypolimnion, which are typically colder and lower in dissolved oxygen. It is possible to control water quality, i.e. temperature and dissolved oxygen, of the releases from a dam of a stratified water mass by selectively regulating the level from which water is withdrawn and differentially mixing water withdrawn from upper and lower strata, the epilimnion and hypolimnion, respectively.

   According to the subject document, three 12-inch gates will be installed in the riser at different levels. There is no information provided which would indicate that the three gates will be used to regulate the water quality of the discharge.

   To assure compliance with Virginia Water Quality Standards, and thus, prevent the degradation of downstream water quality in Great Creek, a program for water quality regulation of releases should be developed. A monitoring station for collection of dissolved oxygen and temperature data should be established downstream from the dam. Based on aforementioned data, the discharge of dam should be controlled, as discussed previously, to maintain dissolved oxygen and temperature pursuant to State standards for Great Creek (classified as Class III-A).

2. As indicated by the subject document, one of the major functions of the reservoir is storage basin for sediment entering Great Creek from upstream watershed. Associated with this influx of sediment to the reservoir will be nutrients from non-point sources, i.e. fertilizers from farmlands and nitrogenous wastes from pastureland. (An additional source of nutrients will be fertilizers applied in the establishment of the vegetative land treatment measures outlined on pages II-7 to II-10).

   In view of the continued importance of farming and grazing activities in the Great Creek Watershed, nutrient enrichment of the project reservoir seems likely. Coupled with sedimentation (about 12,000 tons per year, estimated from Figure 11, page II-50), this nutrient enrichment will accelerate the eutrophication of the reservoir, eventually, causing appearance of algal blooms and a reduction of dissolved oxygen concentrations.

   Eutrophication would severely impair the viability of the reservoir to serve as a public water supply and would negate its attractiveness for public recreation. In addition, the regulated releases from the dam would have lower dissolved oxygen concentrations; thus, downstream water quality in Great Creek could be affected.

3. As outlined on page II-9, under Forest land, insect and disease control are planned on 6,980 acres as part of the land treatment measures for the watershed. A definition of the quantity and quality of pesticides, fungicides, and other chemical control agents to be used and an evaluation of the potential impacts of these substances on aquatic life in Great Creek should be provided in final EIS.

In addition to the above, the staff offers the following comments and recommendations:

1. To minimize sedimentation, construction of the multipurpose structure should be scheduled for the dry months of the year. In addition, cofferdams should be constructed downstream of the proposed dam, to reduce the effect of dam building activities on turbidity in Great Creek.

2. As to the engineering design, the reservoir will be abnormally shallow. At full flood storage, the maximum depth will be 52.1 feet, averaging nineteen feet. The sediment pool will have a maximum depth of twenty feet, while averaging only 6.75 feet. The geomorphologic nature of the channel is not generally acceptable for reservoirs, as indicated by the fact that the average depth with storage of public water supplies will be less than that of the sediment pool, only 5.36 feet. This will lead to mud flats of up to 406 acres (65% of the maximum inundated area) due to the simple release of flood storage.

3. The USGS gauge will probably not be needed when the stream flow is controlled by the structure. Local authorities could read and record flows from the facility. The USGS and SWCB should be contacted for elaboration of this aspect of the plan.

4 Some recreational uses and public water supplies may be incompatible. Many localities regulate or prohibit primary contact recreation (swimming) and power boating in their raw water supplies. The new Federal Regulations for the Drinking Water Act should also be reviewed.

COMMENTS SUBMITTED BY

STATE DEPARTMENT OF HEALTH

FOR
GREAT CREEK WATERSHED
BRUNSWICK AND LUNENBURG COUNTIES

M. J. Haley of the Bureau of Sanitary Engineering has reviewed the information contained in the above listed Report. This project consists of a dam which is located on a large portion of the main raw water supply for the Town of Lawrenceville. We feel that the following factors or items of action should be undertaken:

1. Since this is Lawrenceville's main source of drinking water, residential development, with its accompanying sewage disposal requirements, should be discouraged. This could be accomplished by zoning or other action at the local level.

2. The use of the reservoir as an intensive recreation facility with the use of gasoline operated motorboats, etc., should not be allowed.

3. Surveillance must be maintained to prevent nuisance conditions from developing. These nuisances could result from concentrated recreation activities - problems with litter, solid waste disposal, and wastewater disposal are among the several items that immediately came to mind.

4. The Town should also be prepared to provide corrective action to the water in the reservoir if remedies are needed. These actions may include the use of copper sulfate for control of algae, the use of carbon at the water plant if tastes and odors are detected, etc.

5. Attached are policy statements by the AWWA in which classification of various impoundments are given. We feel that this impoundment should be classed as a Class B (as a minimum) Reservoir with regards to its use.

6. With adequate water recreation sites elsewhere in the area - Lake Gaston for example - we feel that there would certainly be no need for this reservoir to become a major recreation site. This is brought out in the Report on page II-5 in which the three purposes are stated. We agree with the purposes, which we feel are excellent.

7. Multiple withdrawal points at the outlet structure of the reservoir are desirable.

With the above listed comments this to advise that we favor the project.

COMMENTS SUBMITTED BY THE COMMISSION OF GAME AND INLAND FISHERIES FOR THE GREAT CREEK WATERSHED, BRUNSWICK AND LUNENBURG COUNTIES

II-38, para. 1.

Technically, the stream classification attributed to the Commission was carried out by the U.S. Fish & Wildlife Service according to U.S.F.W.S. criteria. Their criteria differs somewhat from that of the Commission. Also, the system utilized was a modification of the Van Deusen system and classifications were not strictly according to the system cited.

2. II-56, WATER QUALITY PROBLEMS.

Possible increases in ferrous iron and manganese levels in downstream waters as a result of the proposed impoundment (II-30, para. 4 ie. water high in iron and manganese), the release of lower level waters from the impoundment during wet periods (in the region of the chemocline), the subsequent reduction of any heavy metals as waters become oxygenated after discharge, and the probable precipitation of iron and manganese oxides (or other inactive forms) has not been discussed under Water Quality Problems or under Adverse Environmental Effects. This potential problem should be described in detail in the final draft since the stated occurrences are not uncommon in areas rich in iron and manganese.

Additionally, no discussions of downstream environmental effects were provided and this oversight should be remedied in the final draft. In particular, the effect of decreasing streamflow by an average of 3.0 million gallons of water per day (4.64 c.f.s.) on aquatic organisms located below the water supply diversion was not discussed under Water Quality Problems or under Adverse Environmental Effects. Surely such a marked reduction in streamflow would have certain adverse consequences to streamlife. Also, re-regulation of streamflow will have certain beneficial (reducing sediment loading) and detrimental effects (differing temperature patterns, differing flow patterns, differing flow patterns, decreased flow due to evaporation, etc.), yet no information regarding these effects or estimates of their probable severity have been provided.

3. II-74, para. 2- No Project.

The argument that accelerated conservation land treatment would not be possible without the project, and an increase in installation time from 5 to 40 years, does not appear germane to the 'No Project' alternative. Other projects could be developed and substituted which would provide the same levels of "accelerated conservation land treatment."

Adverse effects on stream ecology (outlined above) would also be avoided by a no project alternative.

4. II-76, para. 4.

The statement that "the project will improve water quality and quality of wildlife habitat", may or may not be true. Heavy metal

precipitation below the impoundment may offset any gains provided by reduced sedimentation. Decreased streamflow and changes in flow patterns may also decrease water quality.

5. We are pleased to note on page I-11, para. 2 that the impoundment planned for the Great Creek Watershed Project includes plans for public fishing access and facilities. Flood plain zoning and the securing of land rights for an access road (page I-19) are also to be commended.

According to the next to last sentence in para. 5, page I-19, a total of five acres will be purchased for (among other things) bank fishing purposes. No mention is made regarding whether shoreline access to the remaining 4.8 miles of shoreline will be available to the general public. It is recommended that a narrow band of additional shoreline sections be purchased as part of the project for fishermen access purposes if no other shoreline sections will be available.

Joseph B. Willson, Jr.
Director

Donald L. Wells
Deputy Director

COMMONWEALTH of VIRGINIA

VIRGINIA SOIL AND WATER CONSERVATION COMMISSION

830 EAST MAIN STREET, SUITE 800
RICHMOND, VIRGINIA 23219

(804) 786-2064

December 5, 1975

Mr. David N. Grimwood, State Conservationist
Soil Conservation Service
P.O. Box 10026
Richmond, Virginia 23240

Dear Dave:

The Work Plan and Environmental Impact Statement for Great Creek Watershed has been reviewed as requested in your letter dated October 10, 1975. I believe that this project will be a tremendous asset to the citizens of this Southside community by reducing flooding, providing an adequate municipal water supply and reducing sedimentation in Great Creek. We have no comments to offer on either the Plan or the Environmental Impact Statement.

Sincerely,

Joseph B. Willson, Jr.
Director

JBW:ba

APPENDIX D

Typical Land Treatment Practices used in providing conservation treatment of land.

1. Access Road
2. Conservation Cropping System
3. Contour Farming
4. Crop Residue Use
5. Debris Basin
6. Diversion
7. Field Border
8. Grassed Waterway or Outlet
9. Hydrologic Cultural Operations
10. Minimum Tillage
11. Pasture and Hayland Management
12. Pasture and Hayland Planting
13. Recreation Area Improvement
14. Skid Trail and Logging Road Erosion Control
15. Stripcropping, Contour
16. Tree Planting
17. Wildlife Upland Habitat Management
18. Woodland Grazing Control
19. Woodland Improved Harvesting
20. Woodland Improvement

Definitions

1. Access Road 1/: road constructed as part of a conservation plan to provide needed access. Provides access to farms, ranches, fields, conservation systems, structures, and recreation areas; provides a route for travel, for moving equipment and supplies; and provides access for proper operation and management of conservation enterprises.

2. Conservation Cropping System 2/: growing crops in combination with needed cultural and management measures. Cropping systems include rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without the use of such crops. Designed to improve or maintain good physical condition of the soil; protect the soil during periods when erosion usually occurs; help control weeds, insects, and diseases; and meet the need and desire of farmers for an economic return.

3. Contour Farming 2/: farming sloping cultivated land in such a way that plowing, preparing land, planting, and cultivating are done on the contour (includes following established grades of terraces, diversions, or contour strips) in order to reduce erosion and control water.

4. Crop Residue Use 2/: using plant residues to protect cultivated fields during critical erosion periods in order to conserve moisture, increase infiltration, reduce soil loss, and improve soil tilth.

5. Debris Basin 1/: barrier or dam constructed across a waterway or at other suitable locations to form a silt or sediment basin that will preserve the capacity of reservoirs, ditches, canals, diversions, waterways and streams; prevent undesirable deposition on bottomlands and developed areas; trap sediment originating from construction sites; and reduce or abate pollution by providing basins for deposition and storage of silt, sand, gravel, stone, agricultural wastes, and other detritus.

6. Diversion 1/: channel with a supporting ridge on the lower side constructed across the slope for the purpose of diverting water from areas where it is in excess to sites where it can be used or disposed of safely.

7. Field Border 2/: border or strip of perennial vegetation established at the edge of a field by planting, or by converting it from trees to herbaceous vegetation or shrubs, in order to control erosion; protect edges of fields that are used as "turn rows" or travel lanes for farm machinery; reduce competition from adjacent woodland; provide wildlife food and cover; or improve the landscape.

8. Grassed Waterway or Outlet 1/: natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as needed for the safe disposal of runoff from a field, diversion, terrace, or other structure; they provide for the disposal of excess surface water from terraces, diversions, or from natural conditions without damage by erosion or flooding.

9. Hydrologic Cultural Operations 3/: These cultural operations are aimed at improving hydrologic conditions by manipulation of stand composition to create favorable conditions for the maximum production and protection of litter, humus, and forest cover. They include supplemental plantings, weedings, thinnings, improvement, release and harvest cuttings.

10. Minimum Tillage 2/: limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage. This practice retards deterioration of soil structure; reduces soil compaction and formation of tillage pans; and improves soil aeration, permeability, and tilth.

11. Pasture and Hayland Management 2/: proper treatment and use of pastureland or hayland for the purpose of prolonging life of desirable forage species; maintaining or improving the quality and quantity of forage; and protecting the soil and reducing water loss.

12. Pasture and Hayland Planting 2/: establishing and re-establishing long-term stands of adapted species of perennial, biennial, or reseeding forage plants (includes pasture and hayland renovation; does not include grassed waterway or outlet on cropland) in order to reduce erosion, to produce high quality forage, and to adjust land use.

13. Recreation Area Improvement 2/: establishing grasses, legumes, vines, shrubs, trees, or other plants or selectively reducing stand density and trimming woody plants to improve the attractiveness and usefulness of an area for recreation and to protect the soil and plant resources.

14. Skid Trail and Logging Road Erosion Control 3/: to reduce runoff, erosion, and sedimentation by diverting water from skid trails and logging roads. Simple water bars (ditches) with pole or earthen diversions) spaced at specified intervals are the usual means used to divert this type of surface runoff.

15. Stripcropping, Field 2/: growing crops in a systematic arrangement of strips or bands across the general slope (not on the contour) to reduce water erosion. The crops are arranged so that a strip of grass or close-growing crop is alternated with a clean-tilled crop or fallow. This helps control erosion and runoff on sloping cropland where contour stripcropping is not practical.

16. Tree Planting 2/: planting tree seedlings or cuttings in order to establish or reinforce a stand of trees to conserve soil and moisture, beautify an area, protect a watershed, or produce wood crops.

17. Wildlife Upland Habitat Management 2/: retaining, creating, or managing wildlife habitat other than wetland to keep, make, or improve habitat for desired kinds of wildlife.

18. Woodland Grazing Control 3/: fencing out domestic livestock to prevent impairment of hydrologic conditions in woodlands by reducing soil compaction, damage to tree roots, seedlings, and other ground cover and the loss of litter and humus.

19. Woodland Improved Harvesting 2/: systematically removing some of the merchantable trees from an immature stand or all the trees from a designated part of a woodland to improve the conditions for forest growth and/or to harvest trees in a manner that encourages the regeneration and normal development of a new stand.

20. Woodland Improvement 2/: improving woodland by removing unmerchantable or unwanted trees, shrubs, or vines in order to fully use the potential of a site; to maintain plant cover for soil protection; to improve stand composition by leaving the best trees, spaced for best growth; to improve forage production on grazable woodland; or to improve the natural beauty, wildlife, or recreation values of the area.

1/ Engineering Practice Standards and Specifications for Soil and Water Conservation in Virginia, Soil Conservation Service, United States Department of Agriculture, September 1973.
2/ National Handbook of Conservation Practices, United States Department of Agriculture, Soil Conservation Service, July 1971.
3/ Forest Service.

PLANTS COMMON TO GREAT CREEK WATERSHED

CROPS

Common Name	Scientific Name
Corn	*Zea mays*
Oats	*Avena sativa*
Rye	*Secale cereale*
Wheat	*Triticum aestivum*
Ky-31 fescue	*Festuca arundinacea*
Orchardgrass	*Dactylis glomerata*
Redtop	*Agrostis alba*
Italian ryegrass	*Lolium multiflorum*
Sudan grass	*Sorghum sudanensis*
Ladino clover	*Trifolium repens latum*
Korean lespedeza	*Lespedeza stipulaceae*
Sericea lespedeza	*Lespedeza cuneata*
Soybeans	*Glycine max*
White clover	*Trifolium repens*
Sweet clover	*Melilotus spp.*
Tobacco, fire cured	*Nicotiana spp.*
Tobacco, flu cured	*Nicotiana spp.*
Barley	*Hordeum spp.*
Alfalfa	*Medicago spp.*
Timothy	*Phleum pratense*
Sorghum	*Sorghum spp.*

WEEDS

Pigweed	*Amaranthus spp.*
Hemp dogbane	*Apocynum cannabinum*
Chickweed	*Stellaria spp.*
Lambsquarter	*Chenopodium album*
Ragweed	*Ambrosia artemisiifolia*
Giant ragweed	*Ambrosia trifida*
Bitter sneezeweed	*Helenium amarum*
Dogfennel	*Eupatorium capillifolium*
Whiteheath Aster	*Aster pilosus*
Thistle	*Cirsum spp.*
Annual fleabane	*Erigeron annus*
Horseweed	*Erigeron canadensis*
Cudweed	*Gnaphalium spp.*
Wild lettuce	*Lactuca scariola*
Goldenrod	*Solidago spp.*
Dandelion	*Taraxacum officinale*
Cocklebur	*Xanthium pennsylvanicum*
Morning glory	*Ipomoea spp.*
Wild mustard	*Brassica kaber*

WEEDS

Common Name	Scientific Name
Pepperweed	*Lepidium virginicum*
Spurge	*Euphorbia spp.*
Dock	*Rumex spp.*
Pokeweed	*Phytolacca americana*
Corn cockle	*Agrostemma githago*
Primrose	*Oenothera spp.*
Wild onion	*Allium spp.*
Plantain	*Plantago spp.*
Wild carrot	*Dacus carota*
Henbit	*Lamium amplexicaule*
Shephard's purse	*Capsella bursa-pastoris*
Red sorrel	*Rumex acetosella*
Spanish needles	*Bidens bipinnata*
Yarrow	*Achillea spp.*
Milkweed	*Asclepias spp.*
Nutsedge	*Cyperus spp.*
Wood sorrel	*Oxalis stricta*
Smartweed	*Polygonum spp.*
Buttercup	*Ranunculas spp.*
Poorjoe	*Diodia teres*
Jimsonweed	*Datura stramonium*
Horsenettle	*Solanum carolinense*

LEGUMES

Vetch	*Vicia spp.*
Clovers	*Trifolium spp.*
Beggarweed	*Desmodium spp.*
Partridge pea	*Cassia fasciculata*

GRASSES

Broomsedge bluestem	*Andropogon virginicus*
Little bluestem	*Andropogon scoparius*
Indiangrass	*Sorghastrum nutans*
Bermudagrass	*Cynodon dactylon*
Crabgrass	*Digitaria sanguinalis*
Barnyard grass	*Echinochloa crusgalli*
Goosegrass	*Eleusine indica*
Foxtail	*Setaria spp.*
Johnsongrass	*Sorghum halepense*
Purpletop tridens	*Tridens flavus*
Cheatgrass	*Bromustectorum*
Orchardgrass	*Dactylis glomerata*
Fescue	*Festuca spp.*
Low paspalums	*Paspalum spp.*

GRASSES

Common Name	Scientific Name
Low panic grass	*Panicum spp.*
Witchgrass	*Leptoloma spp.*
Annual bluegrass	*Poa annua*
Eastern gamagrass	*Tripsacum dactyloides*

VINES

Wild grape	*Vitis spp.*
Honeysuckle	*Lonicera spp.*
Poison Ivy	*Rhus radicans*
Greenbriar	*Smilax rotundifolia*
Blackberry	*Rubus spp.*
Trumpetcreeper	*Campsis radicans*
Virginia creeper	*Parthenocissus quinquefolia*
Kudzu	*Pueraria lobata*

SHRUBS

Smooth alder	*Alnus serrulata*
Arrowwood	*Viburnum dentalum*
Blueberry	*Vaccinium spp.*
Elderberry	*Sambucus canadensis*
Haw,black	*Veburnum prunifolium*
Hawthorn	*Crataegus coccinea*
Hazelnut	*Corylus americana*
Mapleleaved viburnun	*Viburnum acerifolium*
Sweet pepperbush	*Clethra alnifolia*
Strawberry bush	*Euonymus americanus*
Dwarf sumac	*Rhus copallina*
Smooth sumac	*Rhus glabra*
Spicebush	*Lindera benzoin*

TREES

Common alder	*Alnus serrulata*
Ash	*Fraxinus, spp.*
Red (river) birch	*Betula nigra*
Ohio buckeye	*Aesculus glabra*
Eastern red cedar	*Juniperus virginiana*
Wild cherry	*Prunus serotina*
Crabapple	*Malus angustifolia*
Flowering dogwood	*Cornus florida*
American elm	*Ulmus americana*
Winged elm	*Ulmus alata*

TREES

Common Name	Scientific Name
Slippery elm	*Ulmus rubra*
Black gum	*Nyssa sylvatica*
Sweet gum	*Liquidamber styraciflua*
Hackberry	*Cletis occidentalis*
Bitternut hickory	*Carya cordiformis*
Mockernut hickory	*Carya tomentosa*
Shagbark hickory	*Carya ovata*
Pignut hickory	*Carya glabra*
American holly	*Ilex opaca*
Ironwood	*Carpinus caroliniana*
American beech	*Fagus grandifolia*
Black locust	*Robinia pseudoacacia*
Box elder	*Acer negundo*
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Black oak	*Quercus velutina*
Blackjack oak	*Quercus marilandica*
Chestnut oak	*Quercus montana*
Northern red oak	*Quercus rubra*
Post oak	*Quercus stellata*
Scarlet oak	*Quercus coccinea*
Southern red oak	*Quercus falcata*
Water oak	*Quercus nigra*
White oak	*Quercus alba*
Swamp white oak	*Quercus bicolor*
Willow oak	*Quercus phellos*
Persimmon	*Diospyros virginiana*
Loblolly pine	*Pinus taeda*
Shortleaf pine	*Pinus echinata*
Virginia pine	*Pinus virginiana*
Yellow (tulip) poplar	*Liriodendron tulipifera*
Redbud	*Cercis canadensis*
Sassafras	*Sassafras albidum*
Serviceberry	*Amelanchier canadensis*
Sourwood	*Oxydendrum arboreum*
Sycamore	*Platanus occidentalis*
Black walnut	*Juglans nigra*
Butternut	*Juglans cinerea*
Black willow	*Salix nigra*

FISH SPECIES COLLECTED IN GREAT CREEK
AND EXPECTED IMPACT DUE TO IMPOUNDMENT

Common Name	Scientific Name	Expected Impact
American brook lamprey	*Lampetra lamottei*	E
American eel	*Anguilla rostrata*	E
Chain pickerel	*Esox niger*	S+
Bluehead chub	*Nocomis leptocephalus*	E
Bull chub	*N. raneyi*	E
Creek chub	*Semotilus atromaculatus*	S or E
White shiner	*Notropis albeolus*	E
Highfin shiner	*N. altipinnis*	E
Rosefin shiner	*N. ardens*	E
Swallowtail shiner	*N. procne*	E
White sucker	*Catostomus commersoni*	S+ or S
Northern hog sucker	*Hypentelium nigricans*	E
Suckermouth redhorse	*Moxostoma pappillosum*	S+
Yellow bullhead	*Ictalurus natalis*	S+
Flat bullhead	*I. platycephalus*	S+
Margined madtom	*Noturus insignis*	E
Pirate perch	*Aphredoderus sayanus*	E or S
Redbreast sunfish	*Lepomis auritus*	S or S+
Warmouth	*L. gulosus*	S or S+
Largemouth bass	*Micropterus salmoides*	S+
Fantail darter	*Etheostoma flabellare*	E
Tessellated darter	*E. olmstedi*	E
Glassy darter	*E. vitreum*	E
Roanoke darter	*Percina crassa roanoka*	E
Shield darter	*P. peltata*	E

S = survival; S+ = possible expansion

E = Elimination or severe reduction within impoundment

BIRD SPECIES COMMONLY OBSERVED IN THE GREAT CREEK WATERSHED AREA

Common Name	Scientific Name
Wild turkey	*Meleagris gallopavo*
Bobwhite quail	*Colinus virginianus*
Mourning dove	*Zenaidura macroura*
Rock dove	*Columba livia*
Mallard	*Anas platyrhynchos*
Black duck	*Anus rubripes*
Wood duck	*Aix sponsa*
Redtailed hawk	*Buteo borealis*
Sparrow hawk	*Falco sparverius*
Great horned owl	*Bubo virginianus*
Screech owl	*Otus asio*
Turkey vulture	*Cathartes aura*
Black vulture	*Coragyps atratus*
Crow	*Corvus brachyrhynchos*
Yellow-billed cuckoo	*Coccyzus americanus*
Chimney swift	*Chaetura pelagica*
Downy woodpecker	*Dendrocopos pubescens*
Barn swallow	*Hirundo rustica*
Yellow-shafted flicker	*Colaptes auratus*
Red-bellied woodpecker	*Centurus carolinus*
Eastern kingbird	*Tyrannus tyrannus*
Great creasted flycatcher	*Myiarchus crinitus*
Eastern phoebe	*Sayornis phoebe*
Acadian flycatcher	*Empidonax virescens*
Eastern wood pewee	*Contopus virens*
Purple martin	*Progne subis*
Blue jay	*Cyanocitta cristata*
Carolina chickadee	*Parus carolinensis*
Tufted titmouse	*Parus bicolor*
House wren	*Troglodytes aedon*
Carolina wren	*Thryothorus ludovicianus*
Mockingbird	*Mimus polyglottos*
Catbird	*Dumetella carolinensis*
Brown thrasher	*Toxostoma rufum*
Robin	*Turdus migratorius*
Wood thrush	*Hylocichla mustelina*
Blue-gray gnatcatcher	*Polioptila caerulea*
Starling	*Sturnus vulgaris*
Red-eyed vireo	*Vireo olivaceus*
Pine warbler	*Dendroica pinus*
Prairie warbler	*Dendroica discolor*
Ovenbird	*Seiurus aurocapillus*
Yellowthroat	*Geothlypis trichas*
Yellow-breasted chat	*Icteria virens*
Eastern meadowlark	*Sturnella magna*
Red-wing blackbird	*Agelaius phoeniceus*
Common grackle	*Quiscalus quiscula*
Brown-headed cowbird	*Molothrus ater*

BIRD SPECIES COMMONLY OBSERVED IN THE GREAT CREEK WATERSHED AREA

Common Name	Scientific Name
Cardinal	*Richmondena cardinalis*
Indigo bunting	*Passerina cyanea*
English (house) sparrow	*Passer domesticus*
American goldfinch	*Spinus tristis*
Rufous-sided towhee	*Pipilo erythrophthalmus*
Grasshopper sparrow	*Ammodramus savannarum*
Chipping sparrow	*Spizella passerina*
Field sparrow	*Spizella pusilla*
Song sparrow	*Melospiza melodia*

Sources: The Breeding Bird Survey; 1966, 1967, 1968, and 1969 United States Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and the Breeding Bird Survey in Virginia, 1966-1968, Willet T. Van Velzen.

BENTHOS COLLECTED JUNE 20, 1974, IN GREAT CREEK AT HIGHWAY 763 CROSSING (PRICE MILL)

Order	Family	Genus	Number	Adult and/or Immature
Collembola	?	*?*	2	?
Ephemeroptera	Baetidae	*Isonychia*	1	I
Ephemeroptera	Baetidae	*Pseudocloeon*	1	I
Odonata	Cordulegastridae	*Cordulegaster*	1	I
Odonata	Gomphidae	*Progomphus*	2	I
Odonata	Gomphidae	*Gomphus*	3	I
Odonata	Aeshnidae	*Boyeria*	3	I
Odonata	Libellulidae	*Macromia*	3	I
Hemiptera	Notonectidae	*Notonecta*	7	A
Hemiptera	Gerridae	*Limnogonus*	4	I
Hemiptera	Gerridae	*Gerris*	2	A
Trichoptera	Hydropsychidae	*?*	2	I
Megaloptera	Corydalidae	*Corydalus*	1	I
Coleoptera	Gyrinidae	*Dineutus*	3	A
Coleoptera	Gyrinidae	*Dineutus*	2	I
Coleoptera	Elmidae	*Stenelmis*	2	A
Coleoptera	Elmidae	*Macronychus*	7	I

OTHER FRESH WATER INVERTEBRATES COLLECTED:

Decapoda	Astacidae	*Cambarus*	3 (Crayfish)	I & A
Ctenobranchiata	Viviparidae	*Campeloma*	7 (Snails)	A
Pelecypoda	Sphaeriidae	*Sphaerium*	4 (Fingernail Clams)	A

AMPHIBIANS AND REPTILES

Toads	
American Toad	- *Bufo americanus*
Fowlers Toad	- *B. woodhousii fowleri*
Frogs	
Swamp Chorus Frog	- *Pseudocris nigrita nigrita*
Striped Chorus Frog	- *P. nigrita triseriata*
Ornate Chorus Frog	- *P. ornata*
Common Tree Frog	- *Hyla versicolor*
Green Tree Frog	- *H. cinerea*
Squirrel Tree Frog	- *H. squirella*
Spring Peeper	- *H. crucifer*
Cricket Frog	- *Acris crepitans*
Bullfrog	- *Rana catesbeiana*
Green Frog	- *R. clamitans*
Pickerel Frog	- *R. palustris*
Leopard Frog	- *R. pipiens*
Turtles	
Musk Turtle	- *Sternotherus odoratus*
Common Mud Turtle	- *Kinosternon subrubrum*
Common Snapper	- *Chelydra serpentina*
Eastern Painted Turtle	- *Chrysemys picta picta*
Common Map Turtle	- *Graptemys geographica*
Eastern Box Turtle	- *Terrapene carolina*
Snakes	
Mud snakes (Hornsnake, Hoopsnake)	- *Farancia abacura*
Ring-necked snake (Eastern Ring-neck)	- *Diadophis punctatus edwardsi*
Keeled green snake (Rough green snake)	- *Opheodrys aestivus*
Ground snake (DeKay's, Brown, Storer's snake)	- *Storeria DeKayi*
Hog-nosed snake (Common, Puff "adder," Hissing "adder")	- *Heterodon contortrix*
Worm snake	- *Carphophis amoena*
Rat snakes	
Black rat snake (Pilot black snake, black chicken snake)	- *Elaphe obsoleta obsoleta*
Gray rat snake	- *E. Obsoleta confinis*
Corn snake (Red rat snake)	- *E. guttata*
Pine snake (Bull snake, Gopher snake)	- *Pituophis melanoleucus melanoleucus*
King snakes	
Common	- *Lampropeltis getulus getulus*
Brown	- *L. rhombomaculata*
Milk snake (house snake)	- *L. triangulum triangulum*

AMPHIBIANS AND REPTILES (Continued)

Snakes

Garter snakes	
Ribbon snake	- *Thamnophis sauritus sauritus*
Common garter snake	- *T. sirtalis sirtalis*
Common water snake	- *Natrix sipedon sipedon*
Southern banded watersnake	- *N. sipedon fasciata*
Brown water snake (watersnake, water pilot)	- *N. taxis pilota*
Valeria's snake (Ground snake)	- *Virginia valeriae valeriae*
Racer black snake	- *Coluber constrictor constrictor*
Coachwhip	- *Masticophis flagellum flagellum*
Poisonous	
Copperhead	- *Agkistrodon contortrix*

The above amphibians and reptiles were primarily collected and/or identified in the field by Mrs. Coleman's high school biology class, Lawrenceville, Virginia, during September and October 1974 from the Great Creek Watershed.

APPENDIX F

GLOSSARY

Alluvium	-	A general term for all detrital deposits resulting from the operations of modern rivers, thus including the sediments laid down in riverbeds, flood plains, lakes, fans at the foot of mountain slopes, and estuaries.
Benefits	-	The value of increased output of goods and services, the value of output resulting from external economics, and nonmonetary beneficial effects on environmental and social well-being resources.
Biota	-	The flora and fauna of a region.
Branch	-	A stream that flows into another usually larger stream. A tributary.
Channel Improvement	-	The improvement of the flow characteristics of a channel by clearing, excavation, realignment, lining, or other means in order to increase its capacity. Sometimes used to connote channel stabilization.
CL	-	The Unified Soil Classification System symbol for: Inorganic clays of low to medium plasticity.
Conservation Land Treatment Measures	-	Construction and management-type practices normally planned, installed, and maintained by individuals or groups of landowners on their own lands to efficiently use and protect the land and water resources. These measures serve to reduce runoff, erosion, and sediment that would restrict land use, adversely affect the environment, and reduce the realization of maximum benefits from other existing and proposed measures.
Costs	-	The value of all resources required for or displaced by proposed project measures, the value of losses in output resulting from external diseconomics, and nonmonetary adverse effects on environmental and social well-being resources.
Drainage Area	-	The area draining into a stream at a given point.

GLOSSARY (Continued)

Ecology	-	The study of the interrelationships of living organisms to one another and to their surroundings.
Ecosystem	-	Recognizable, relatively homogeneous units, including contained organisms, their environment, and all of the interactions among them.
Emergency Spillway	-	A rock or vegetated earth waterway around a dam, built with its crest above the normally used principal spillway. Used to assist the principal spillway in conveying extreme amounts of runoff safely past the dam.
Emergency Spillway Crest	-	The elevation at which, if exceeded, water starts flowing through the emergency spillway.
Erosion	-	The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. Detachment and movement of soil or rock fragments by water, wind, ice, or gravity.
Eutrophication	-	The normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestrial state and disappears. During eutrophication the lake becomes so rich in nutritive compounds, especially nitrogen and phosphorus, that algae and other microscopic plant life become super-abundant, thereby "choking" the lake, and causing it eventually to dry up. Eutrophication may be accelerated by many human activities.
Fauna	-	The animal life of a region.
Fifty-year Flood	-	See Frequency.
Flood	-	In common usage, an event where a stream overflows its normal banks.
Flood Detention Pool	-	The total volume of space provided between the elevations at which discharges begin through the principal and emergency spillways, less any capacity between these two elevations reserved for sediment and/or water supply.

GLOSSARY (Continued)

Flood Plain	-	The land area bordering a river or stream which is subject to flooding.
Flood Plain Management	-	Reducing potential flood losses by land treatment, nonstructural, and structural measures, or combinations thereof.
Floodwater Damage	-	The point of beginning damage is that elevation above which floodwaters cause economic losses.
Floodwater Retarding Structure	-	A single-purpose structure providing for temporary storage of floodwater and its controlled release.
Flora	-	The plant life characteristic of a region.
Frequency	-	An expression or measure of how often a hydrologic event of given size or magnitude should, on an average, be equaled or exceeded. For example, a 50-year frequency flood or 50-year flood should be equaled or exceeded in size, on the average, only once in 50 years. In drought or deficiency studies, it usually defines how many years will, on the average, be equal to or less than a given size or magnitude.
GM	-	The Unified Soil Classification System symbol for silty gravels, gravel-sand-silt mixtures.
Ground Water	-	The water in a saturated zone beneath the water table. A source of base flow in streams.
Impact Basin	-	A reinforced concrete energy dissipator attached to the outlet of the principal spillway conduit to partially absorb, through impact, the water's energy before releasing it into the stream channel.
Intermittent Stream	-	A stream which flows only part of the time, as after a rainstorm, during wet weather, or during only part of the year.
Main Stem	-	The principal stream of a watershed to which all streams tributary to it feed.

GLOSSARY (Continued)

Mast	-	Nuts (as beechnuts and acorns) accumulated on the forest floor and often serving as food for wildlife or other animals.
ML	-	The Unified Soil Classification System symbol for inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
Multiple-Purpose (Use)	-	In the case of water resources, development of a particular water resource to serve two or more purposes simultaneously.
Natural Streams	-	Those streams in an unaltered and unpolluted condition.
Nonstructural Measures	-	Items such as flood insurance, flood warning systems, flood plain zoning or acquisition, flood proofing, relocating existing developments in flood-prone areas, building codes, and other land use controls or restrictions for achieving project objectives.
One-hundred-Year Flood	-	See Frequency.
Perennial Stream	-	A stream which flows throughout the year.
Principal Spillway	-	A concrete or metal pipe or conduit used with a drop inlet dam or floodwater retarding structure. It conveys, in a safe and nonerosive manner, all ordinary discharges coming into a reservoir and all of an extreme amount that does not pass through the emergency spillway.
Project Agreement	-	A written agreement entered into between the Soil Conservation Service and the sponsor(s) in which detailed working arrangements are established for the installation of works of improvement or other related purposes.
Project Area	-	See Watershed.
Project Measures	-	An undertaking for watershed protection; flood prevention; the conservation, development, utilization, and disposal of water; the conservation and proper utilization of land; or a combination thereof. The undertaking may consist of land treatment, nonstructural or structural measures, or a combination thereof.

GLOSSARY (Continued)

Reach	-	A length of stream, selected for convenience in a study.
Recreation Areas	-	Such areas as scenic, hunting and fishing, national and state forests, parks, monuments, refuges, drives, and campgrounds.
SAF Outlet	-	That type of energy dissipator developed in the Saint Anthony Falls hydraulics laboratory.
Sediment	-	Soil or mineral material transported by water and deposited in streams or other bodies of water.
Sediment Pool	-	Reservoir storage provided for sediment, thus prolonging the usefulness of floodwater pools.
SM	-	The Unified Soil Classification System symbol for silty sands, sand-silt mixtures.
Storage	-	The impoundment in surface reservoirs or accumulation in underground reservoirs of water for later use or release.
Structural Measures	-	Items such as dams, diversions, basins, dikes, pipe lines, conduits, channels, fences, pits, ponds, fish ladders, fish shelters, drops, checks, flumes, control gates, pumping plants, and outlet structures when the item are excavated or constructed with concrete, earth, masonry, metal, rock, or other materials, and vegetation which is a part of the structure.
Ten-year-Flood	-	See Frequency.
Tributary	-	A stream feeding a larger stream or lake.
User fee	-	A monetary charge made upon direct beneficiaries (users) of a water project, designed to recover part or all of the installation cost plus operation and maintenance costs of the project.
Watershed	-	All the area contained within a drainage divide above a specified point in a stream.
Water Supply Pool	-	Reservoir storage provided between the elevations of the sediment pool and flood detention pool, used for municipal and industrial water supply purposes.

GLOSSARY (Continued)

Water Table - The upper surface of ground water.

List of abbreviations.

architects and engineers	A&E
acre feet	ac-ft
animal unit months	aum
biochemical oxygen demand	BOD
board foot	bd ft
cubic foot	cu ft
cubic feet per second	cfs
cubic feet/second/square mile	csm
dissolved oxygen	DO
formazin turbidity units	FTU's
micrograms per liter	ug/l
milligrams/liter	mg/l (ppm)
milliliter	ml
million gallons per day	mgd
parts per million	ppm
gallons per capita per day	gpcd
gallons per minute	gpm

SURFACE WATER ANALYSIS 1/

Parameter	Range From		Range To	
A. Chemical				
Calcium, Ca.	4.0	mg/1	4.8	mg/1
Magnesium, Mg	1.2	mg/1	2.0	mg/1
Chlorides, Cl	2.0	mg/1	3.4	mg/1
Sulfate, SO_4	2.1	mg/1	2.8	mg/1
Bicarbonate (HCO_3)	18.0	mg/1	27.0	mg/1
Iron (Fe)	0.96	mg/1	2.3	mg/1
Manganese (Mn)	0.05	mg/1	0.15	mg/1
Acidity	3.0	mg/1	10.0	mg/1
Alkalinity	18.0	mg/1	27.0	mg/1
Total Hardness, $CaCO_3$	17.0	mg/1	21.0	mg/1
BOD	1.0	mg/1	2.0	mg/1
Dissolved Oxygen	8.6	mg/1	11.0	mg/1
Nitrate, NO_3	<0.01	mg/1	0.05	mg/1
Phosphate, PO_4	0.16	mg/1	0.33	mg/1
Total Dissolved Solids	60.0	mg/1	80.0	mg/1
Toxic Elements & Chemicals indicated as Pollution Sources	None			
B. Physical				
Water Temperature	28 °C		17 °C	
Air Temperature	30 °C		18 °C	
Turbidity	2.2	mg/1	35.0	mg/1
Color	35.0		75.0	
Odor	None detectable			
pH (field)	6.5		7.0	
pH (laboratory)	6.8		7.3	
Suspended Solids	1.0	mg/1	7.0	mg/1
Total Dissolved Solids	55.0	mg/1	80.0	mg/1
Mean Daily Flow	12.0	cfs	20.0	cfs
C. Microbiologic				
Total Coliforms/100ml	1500 - 1500+			
Fecal Coliforms/100ml	0 - 140			

1/ Great Creek Impoundment Study, Brunswick County, prepared by Gilbert W. Clifford and Associates, Inc., November 1974. Samples were taken at the water treatment plant between 6/12 and 10/4/74.

SURFACE WATER ANALYSIS 1/

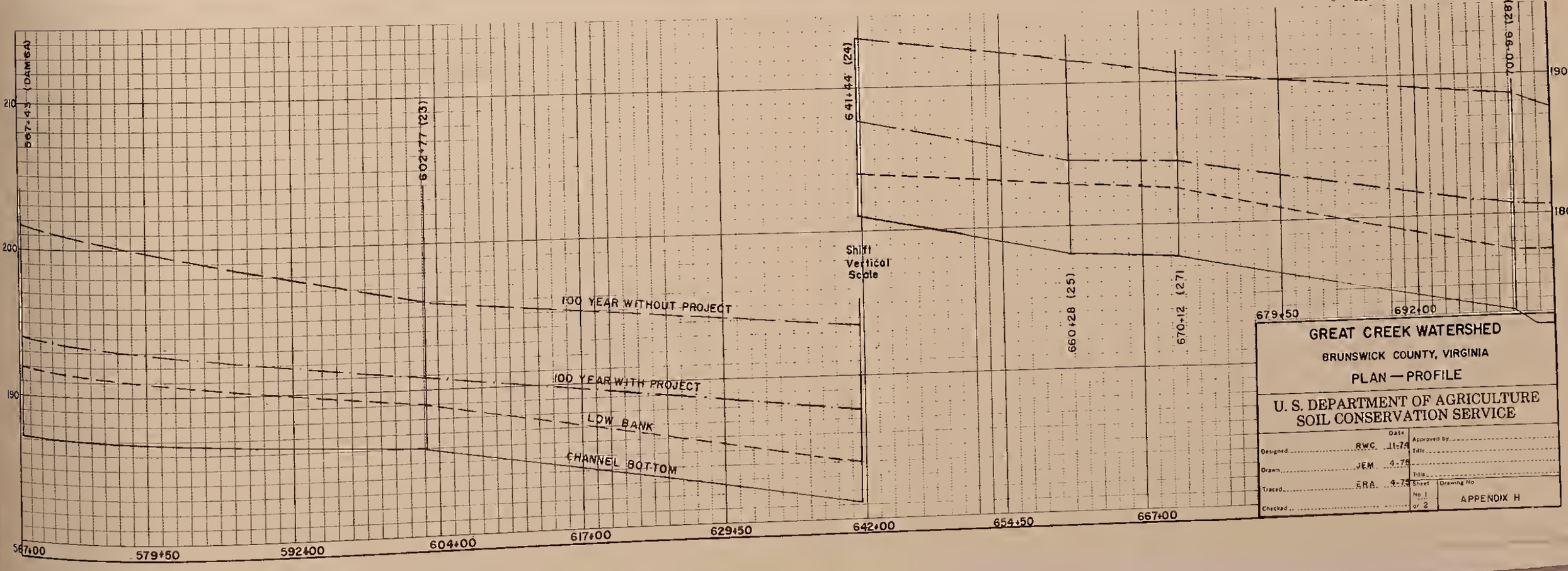
State Code	Parameter	Sample Numbers 1	2	3
055	Coliform, Fecal/100 ml	100	100	100
050	pH (Laboratory)	6.6	6.6	6.5
022	Alkalinity	15	14	11
024	Total Solids, Total	75	82	64
025	Volatile	34	26	40
026	Fixed	41	56	24
027	Suspended Solids, Total	4	16	20
028	Volatile	2	14	16
029	Fixed	2	2	4
033	Chloride	4	3	4
035	Nitrogen, Total Kjeldahl	0.5	0.4	0.4
065	Phosphorus, Total	0.1	0.1	0.1
064	Phosphorus, Ortho	0.1	0.1	0.1
036	Ammonia mg/l as N	0.1	0.1	0.1
037	Nitrate mg/l as N	0.01	0.01	0.01
038	Nitrate mg/l as N	0.13	0.12	0.10
019	BOD_5	2	2	2
051	COD	16	16	40
	TOC, Total Organic Carbon	10	10	11
	Mean daily flow (cfs)	60	60	60

1 Off Rt. 46, 2.1 miles above Lawrenceville.

2 Off Rt. 46, 2 miles above Lawrenceville.

3 Off Rt. 46, 2.2 miles above Lawrenceville.

1/ Samples taken at the impoundment site on February 12, 1975, by the State Water Control Board.



GREAT CREEK WATERSHED

BRUNSWICK COUNTY, VIRGINIA

PLAN — PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	RWC	11-74	Approved by	
Drawn	JEM	4-75	Title	
Traced	ERA	4-75	Sheet No. 1 of 2	Drawing No. APPENDIX H
Checked				

GREAT CREEK WATERSHED

BRUNSWICK COUNTY, VIRGINIA

PLAN — PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed	AWC 11-74	Approved by	
Drawn	JEM 4-75	Title	
Traced	ERA 4-75	Title	
Checked		Sheet No. 2 of 2	Drawing No. APPENDIX H

HNRA-SCS-HYATTSVILLE, MD. 1975